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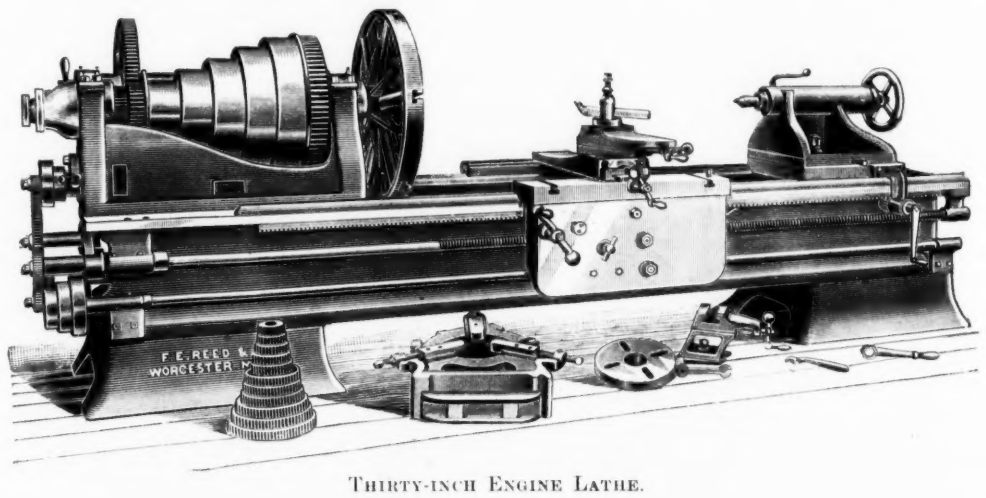
Thirty-inch Engine Lathe.

The accompanying illustration represents a new thirty-inch swing engine lathe recently brought out by F. E. Reed & Co., Worcester, Mass.

The bed is of unusual depth for a lathe of this size, and is well tied together. The outside Vs of the bed, on which the carriage moves, are much larger than the inside Vs, for the purpose of giving larger bearing surface for the carriage to move upon.

The live spindle is made from a crucible steel forging, and runs in boxes made of cast-iron lined with genuine babbitt metal, which is put into the boxes in such a manner that it cannot work loose. The front bearing is 4½″ diameter by 9⅜″ long.

The cone pulley has five sections, the largest of which is 21″ diameter for a 4″ belt, and the spindle is strongly back-geared. Special care has been taken to make these gears so they will run smoothly. The rest has long bearings on the Vs, and is securely gibbed front and back. The feed works are driven by an independent rod and patent friction feed, and by a simple variable feed, so that a large range of feed can be obtained. The power cross-feed is so arranged that the gearing does not lock in with the lateral feed and break out the teeth of the gearing, in case both feeds are put in operation at the same time. The lead screw is made of steel, and is operated in connection with an open and shut nut. The rack pinion is arranged to disengage from the rack when cutting screws. The screw gearing is compounded to give a large range of threads. The foot-stock is stiff and strong and has a long bearing on the bed. It is moved by a pinion gear in connection with the rack on the bed, and carries a spindle of ample size. This lathe with a 12-foot bed complete weighs 7,850 pounds. With the lathe is furnished a countershaft having patent friction pulleys 18″ diameter.



THIRTY-INCH ENGINE LATHE.

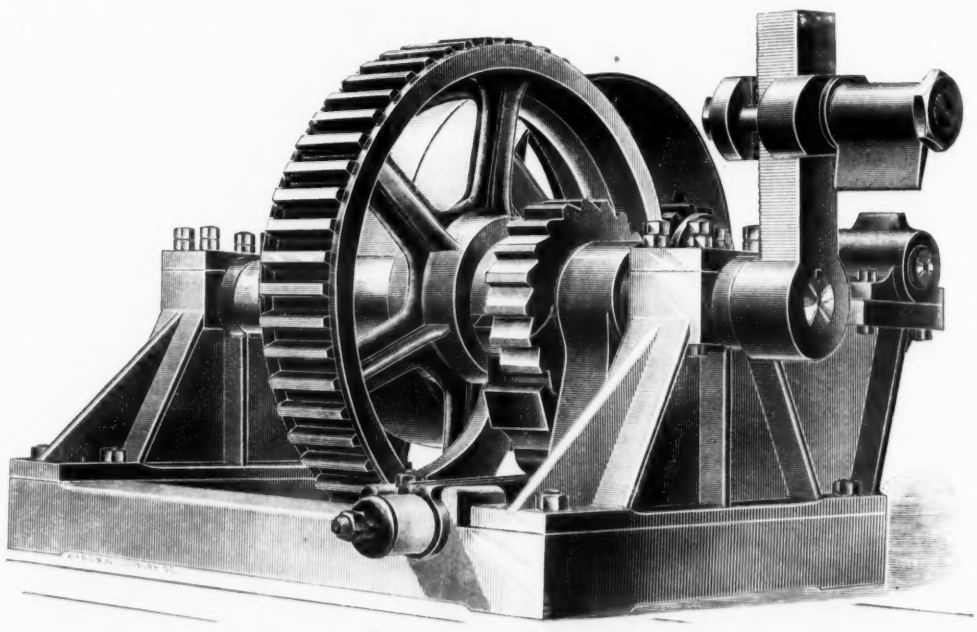
New Design of Drop-hammer Lifter.

The illustration given herewith is designed to show some improvements which have been made in the larger size of the Peck drop-hammer lifter, the severe service required of these having developed in some cases weaknesses which were unexpected, and which did not manifest themselves on the smaller sizes. To begin with, the frame itself has been made much heavier, and the length of the bearings on the main shaft made longer, the caps on these bearings being secured by bolts which pass entirely through the frame, and are provided with check-nuts at the top, as shown, the former practice being to tap these bolts into the frame. In this machine the bearings are the same diameter at each end of the shafts, and, since the hubs of the lift and dog-cranks are made to serve as collars for the main shaft, this shaft has no shoulders whatever upon it, but is a straight plain shaft of uniform diameter from end to end. The strength of the gear wheel and pinion has also been increased, both these having shrouded teeth.

The bearings for the back shaft are bushed with plain cylindrical bushings, which are readily replaced when worn, and there is ample provision for thorough lubrication.

In these larger sizes it is found that the lifter works better not to have the sockets divided, and with rubber springs inserted in flanges, but to insert a rubber cylinder in the cavity in hammer under the lifter belt. This arrangement allows the pinion on the back shaft to be placed in center of its shaft, instead of at the end next to bearing. When thus arranged, should any extra strain accidently come on pinion, the shaft will spring and relieve the frame, whereas, if pinion is close to frame, an extra strain, such as breaking of tooth of gear or pinion, would be liable to break the frame. The crank illustrated is the latest improved fine adjusting crank for silver and other fine work, and enables the blow to be changed in length by half-inches, the change being made by means of the clamp which holds the crank-pin solidly to the crank. The shafts are made of hammered crucible steel; cranks, ratchet, and dog of forged steel.

It is made by the Miner & Peck Manufacturing Co., New Haven, Conn.



DROP-HAMMER LIFTER.

Drop Dies—Selection of Steel for—Using and Repairing.

BY B. F. SPALDING.

After drop dies have been in service for a time, small checks and cross-cracks appear around the edges of the impression, which a longer term of service develops into larger ones with protruding lips. The closer these checks are to each other the better it is for the die. The anomaly is presented that, while it is for the good of the die that checks should be prevented from getting into it, yet when they do come, it is well that they come thickly. The more of them there are in a circumscribed limit the smaller they will be, and the longer it will take them to open to such a size as to require closing.

They will require to be closed when their lips protrude into the body of the piece which is dropped in them, or when they have opened so much that the hot stock, forced into them, causes the dropped piece to stick in the die.

When the checks appear at a tolerably regular, and but a small distance apart, the die will sometimes stand longer after the first "doctoring" before it requires the same treatment again, than it did before it came to fixing, in the first place.

There is, probably, no particular trick of ingenuity that is especially excellent as a method of closing up the checks. That which naturally presents itself to a mechanic is efficacious; simply the process of moving the surrounding stock by sets and punches, in the manner of pening up a crack, starting it back from as far as it is deemed advisable to close in, at the roots of the check, first, and driving in the lips last, to condense and harden the final filling.

A die which is properly dressed will look as well as a new die, and the alteration in its size will be scarcely perceptible, except under accurate gauging. Experienced hands in staking up dies will close up quite large cracks so that they cannot be seen, when it would puzzle a novice to know where to get the stock from to fill them. It is moved from some distance under the gentle influence of rounded sets, whose successive indentations are so close together as to simulate a smooth surface. Occasionally a foreign piece is imbedded for filling, with something of the skill the Afghanistans display in their inlaid metal work, that oriental skill which taught western barbarism the mechanical aphorism, "Every hole can be fitted."

Checks in dies are produced by the expansion and contraction of the metal around the impression. The expansion is caused by the sudden acquisition of heat from the hot material, which is forced against the walls of the die when the blow is struck, which heat is communicated very quickly to the edges of the die with which it comes in very close contact, and causes a rim of the metal close to the edge to expand. When the hot material is removed from the die, the heat in this rim is diffused through the body of the die, and the rim contracts by the cooling it thus undergoes. Why should the expansion and contraction cause it to crack?

If we take a piece of steel half an inch square and six inches long, and put it into a clamp bearing against the ends, which is so large and strong that it will not be affected while we heat the half-inch piece it holds to a bright heat, the piece will yet expand; speaking loosely, the particles will swell, and as they are restricted from growing length-wise, they will develop sidewise, and during the whole time while the piece is heating it will press against the ends of the clamp, and continue to be six inches long, but when it begins to cool it will commence to shorten, and when it is cold it will be, say, an eighth of an inch less than its original length. It could get to be only six inches long while it was being heated in the clamp, and it must get less than six inches long as it shrinks in cooling.

Now the heated rim around the impression in a die acts in the same manner in expanding with the sudden increment of heat from the hot piece which is struck in it, that the piece of half-inch steel does in the clamp; the body of metal composing the die acting in this case as the clamp holding the heated part from expanding in length, but this heated rim cannot shrink from the two

ends as it cools off, like the piece of half-inch steel, for it is confined all the way, by its adhesion to the less heated adjacent parts of the body of the die, and in cooling from the effects of the first blow struck in it, it experiences a stress on the most exposed side, tending to destroy its longitudinal cohesion, and to this and recurring stresses it finally gives way, breaking into checks, which are more or less regular and fine, as the stock is more or less homogeneous—of equal tenacity and texture.

The fineness of the checks also depends in some measure upon the depth to which the rim is heated by the hot piece remaining in contact with it for a longer or shorter period; the shorter this period is, the less depth will the heat penetrate, and the finer will be the checks. The degree of mechanical expanding stress to which the die is subjected in compressing the work within it, also influences the character of the checking. When this is excessive, so that the die yields to it in some measure, the tendency appears to be to create checks more abundantly, as may sometimes be observed in cases where the upper die is not as finely checked as the lower one, although the latter is in contact with the hot work for a much longer time than the former, and for this reason, if it were not for the greater stress upon it, would check coarser. This cause may not be deduced from the behavior of a single pair of dies, but when the same occurs repeatedly, the cause must be found in a constant circumstance, which must be the duty which the dies perform, for it would not be probable that the poorest piece of steel would happen always to be the upper die.

By the way, the poorest piece of steel for some uses may be the best for others. As far as checking is concerned, it makes no difference whether the body of metal which, in resisting the expansion and contraction causes checks, is outside or inside of the surface exposed to the heating. In the issue of the AMERICAN MACHINIST Dec. 1, 1892, page 4, is described the upsetting of round pipe around a square plug to form a square hole. This plug, about two inches long and an inch square, is driven forward into the hot pipe, and immediately withdrawn, but while it is in there, the stock of the pipe is very strongly compressed around it, which causes it to absorb heat rapidly on its surfaces. It is cooled by a stream of water when it is withdrawn, before the interior is heated. In this case, the resistance to expansion and contraction which causes its corners to check is offered by the immobile interior. These plugs when made from good tool steel checked very badly, but by one of those accidents, which are sure to happen when there is any possibility that different kinds of steel can get mixed, a lot of plugs was made of low steel, and it was found that they withstood the hardship much better than the others, and the low steel was adopted in preference to the higher grade. The substitution would be economical, even if the cost of the low steel was considerably higher than the other.

Saying nothing about why steel hardens, but taking the simple fact that it does not harden when slowly cooled, and does harden when cooled quickly, it is very evident that the steel which conducts heat best will harden deepest, because the heat will be transmitted to the water from a distance with greater rapidity. So, also, the steel in drop dies, which is the best conductor of heat, will be penetrated deepest by the heat gained from contact with the work dropped in them. As the greater depth affected by the sudden increment and decrement of heat tends to produce coarser checks, a great conductive and hardening capacity in steel for dies, in which hot work is to be worked, is not as desirable as it is in dies for striking cold metal, because the conditions for deep hardening and fine checking do not appear to co-exist in the die steel ordinarily furnished.

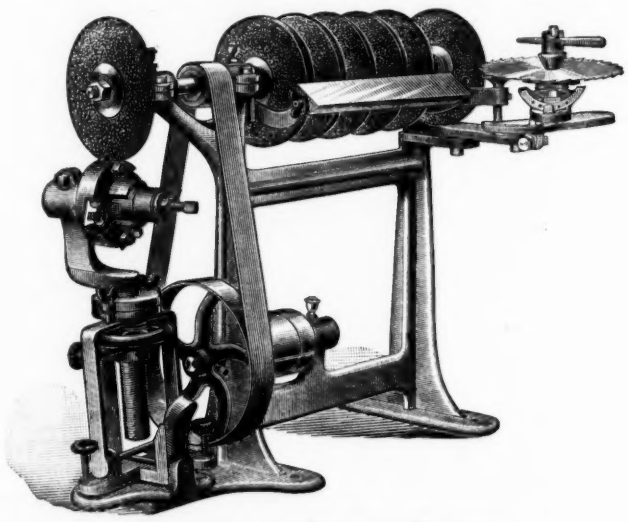
Deep hardening is not as essential in dies for working hot metal as capacity of endurance. If the bottom of a die does not beat down on account of the softness of the stock beneath it, and by settling, deform the work or set up a splitting strain, the die is hardened as deeply as is necessary. In dropping cold work there is a much greater liability of injury to the die from driving down the bottom, and much less from checking, although dies used exclusively for compressing cold work will check in time, as may be observed by looking under the heads of wire nails and rivets. These checks are fine, although the dies must be made of steel which is thoroughly hardened, to prevent them from indenting. The cause of this checking must be the same as in dies for hot work, except that in this instance the heat is due to the compression of the stock in heading, which is communicated to the dies at every stroke. It is not as intense as that from hot work, and does not manifest its effects as quickly, but its continued intermittent influence, though mild, is persistent, and is graven upon the dies in light and numerous checks.

The form which is given to the surfaces of dies which cannot be used plain requires careful consideration. When it is necessary to make an offset in the face of a die, to conform to the shape of the piece which is to be dropped, and a part of the impression is to be cut in it, the offset should not have a sharp interior corner, if it can be avoided, because a check will be almost certain to start in the impression at that point, and on account of its situation it will extend faster than checks in less exposed parts and cause the work to stick. In such places, checks cannot be closed up without more than ordinary difficulty, and thus around the offset becomes the least enduring part of the die. By changing the parting line of the dies on the piece, it is sometimes possible to avoid making a sharp corner in the offset of the die block, leaving it rounding and less liable to check, while the impression which is cut in it may still be made to have the sharp corner required to perfect the dropped piece.

Another thing which may be considered in forming dies with curved or irregular faces, is that if properly shaped, they may have an advantage over plane-faced dies in regard to the liability of moving endwise in the drop. If they are correctly balanced to the work, the force of the blow and the resistance of the fin will tend to make them mesh correctly, but if they are not so balanced, the force of the blow continually tends to drive them out of place. When the tendency to displacement is excessive, it may sometimes be remedied on old dies by planing the tenons to an improved angle with the trend of the faces, or on new dies by bettering the parting line.

The capacity of endurance which die steel may possess cannot be predicted from its susceptibility to softening by annealing. Some steel will anneal better than some other by a particular process, and the results may be reversed by another process. There is a constitutional difference. It would be strange if two batches of steel were ever constituted exactly alike, and the effects of slight differences are marvelous, but at the present time, tolerable uniformity can be secured by dealing with responsible manufacturers.

A few years ago a concern that used many dies for forging a specialty had become so well suited with a brand of steel that the managers had ceased to pay attention to it, when one morning they discovered two things—one was that their stock was low, the other that the manufacturers had quit business. They were forced to experiment with other brands, and had such bad luck that they had to keep six die sinkers at work daily until a late hour at night, and still were not able to produce their regular amount of forgings. One manufacturer was so sure of the satisfactory quality of his steel, that he sent them a ton and a half of it. After thorough trial, they sent him word that they would return it; it was worthless for dies. He sent on an expert, who laid the blame onto the working of the steel in annealing and hardening, but after a thorough trial he acknowledged that the steel would not do the work. With this fact to start on, the steel maker instituted a series of experiments, which resulted in producing a steel which was easy to work with cutting tools, was said to be quite low in carbon, but tempered hard enough for the purpose, and endured the usage at the drop so well, that it is not uncommon to make 18,000 pieces with a single pair of dies. The steel checks fine, and the dies actually wear out by the flow of the hot metal. Although more pieces are made now than ever before, one man working five hours in a week keeps up with the demand for dies. Part of this gain is attributable to improved means and methods of making the dies. The time required for making a die is reduced from three hours, which was quick time formerly, to forty minutes, which is quick time now.



WOOD-WORKERS GRINDING MACHINE.

A Wood-worker's Grinding Machine.

The accompanying illustration is of a machine which is especially designed to do most of the grinding required where various forms of wood-working machinery are used.

As will be perceived, it consists of a frame of the usual form carrying an arbor at the top, which is driven from a countershaft attached to the frame. At the left-hand end an extension of the frame supports a device for holding shimmer heads while the cutters are being ground in their places, this device, as will be seen, having all the usual and necessary adjustments for giving the required form to cutters in heads of any diameter or form.

At the opposite end of the frame is the device for saw sharpening and gumming, this also having adjustments, and all needed facilities for grinding circular saws of any kind.

The wheels placed on the arbor between the boxes are intended for promiscuous grinding of tools, or anything which may require to be ground, the object in providing so many of them being to have them in different forms for the different classes of grinding, so that a wheel adapted to almost any possible requirement may be at hand and ready for use at any time. These wheels can be of any desired form—to suit special cases if need be, and all are 8″ diameter. The weight of the machine is about 250 pounds, and it is made by Samuel C. Rogers & Co., 27 Lock street, Buffalo, N. Y.

Manufacturing in Birmingham—James Watt's Shop—Tangye's.

In "Industry" a series of very interesting articles is just closing, called "Extracts from a Note Book," by "Techno," whom we strongly suspect is Mr. John Richards himself. In this last installment of the series the following passages occur:

I am now convinced that our progress in this world depends greatly, if not entirely, on what others know, do and think, and there is no longer a mystery to my mind in China's standing still for some thousands of years, with a wall of masonry on the Tartar side and a wall of bigotry on all sides.

I find engineers, mechanics and men much the same everywhere, with like faculties, powers and traits, and have discarded my little gauge of personal prejudice for something I hope is more rational and true.

* * * * * *

We went down to Birmingham. What queer places the English select for cities! It is a matter of accident. Birmingham is an accident. Set on hills, valleys and all kinds of sidling ground. Its name, too, is an accident. Brumagen, it is called sometimes, but the name originally was Borough Meecham, the Borough of Meecham.

The things made here would require a book to enumerate, mostly of metal, such as pens, buttons, guns, jewelry, hardware and the like. There is not much science in the manufactures here, but a great deal of ingenuity, skill empirically acquired. For example, there is a way of eliminating imperfect spots on gun barrels by welding in the flaws or spots. This is done only by the "barrel welders." No one else knows how or cares to learn. A double-barrel gun is made in a score of places by different people, each performing his particular part. It is the old system, as we would say, the opposite of the factory system, with advantages and disadvantages in both a social and a mechanical sense. It leads to individuality, and that leads to a good many things desirable, but it costs more.

Of one thing there is no doubt. No people work harder than Englishmen. They work "with a will," and produce also. If not, how do they compete with their German, French and Belgian brethren that are within sight across the channel, and no tax to keep their products out, the continental workmen receiving about half as much wages?

By the way, I have been watching this wages matter all along and find that it is not the wages that governs work, but the work governs the wages; that is, men are paid in proportion to what they do or produce. But that is no discovery, because how could it be otherwise? All sell in the same markets, and if the Belgians can hire a man for 75 cents a day, how can the English compete and pay $1.50 a day? This wages problem as commonly presented is bosh. It was better understood a hundred years ago than it is to-day.

We went out to Soho, where James Watt lived, or worked rather, because he lived and is buried at Handworth, about two miles away. James Watt & Co. have a queer old shop at Soho—old in parts, but not all over. In one section there are square cast-iron line shafts with long wooden drums nearly the whole length. In other parts all is modern. One old "grasshopper" engine was "put down by Jamie himself" as the man in charge told us. He said his father, who had managed the engine, had put new brasses in her, but he did not know when—before he was born forty years ago. The sewage pumping engines at Pimlico, in London, were made at the works of James Watt & Co.—about as advanced practice as can be found at this day.

The British copper pennies are coined here by contract. Mathew Bolton, James Watt's partner, undertook this coining of pennies about 100 years ago, and it has gone on since. Just alongside of James Watt & Co. are the

famous works of Tangye Bros., which we visited, and are here set down, all things considered, as the most advanced works of the kind in the world. My uncle, who knew the works well, said: "They 'manufacture' engines here, others 'make' them. Tangye Bros. have built these works and made their money mainly by making American things and inventions, which were always paid for and acquired in a business manner. These methods you see here, which we call a division of labor, or the duplicating system, is an American idea in such manufactures, but there is no chance to apply it on such a scale as this at home. We have no such market, and, it seems, do not want any. These men have five hundred millions of customers; when one country stops buying another begins. There are nearly one thousand engines finished and in process here, counting steam pumps. There is nothing strange in a shelf thirty feet long, covered with crossheads piled up four high, or a pile of connecting rods that reminds one of a cane shed in Louisiana. It is only in proportion to the market and a result of natural prices for material, grit and confidence. These men are Quakers, from Cornwall, brought up to believe that they are the equals of any people, and they have proved it. Put a tax of twenty-five per cent. on their iron and they would fail in a year. Their net profits don't begin to amount to half that much."

The social arrangements of the men, about 3,000 strong, are a revelation to me. They are like a government, have all kinds of internal provisions like a country. Medical attendance, books, insurance funds and the like are all provided for. The general manager, Mr. George Tangye, is a kind of leader for them; lectures, advises and meets with them, not as a master out of business hours, but as a citizen. The master part begins and ends with the bell. I am acquiring some rational insight of the British engineering trades and the elements of one kind or another that make up that vast interest.

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Several Ways of Molding a Four-chambered Ventilator Shaft—II.

BY S. BOLLAND.

As a loam job, to be cast whole and in vertical position, we encounter a new order of things altogether; the requirements are so much different from the case we have been discussing as to make the business of molding this shaft in loam appear another trade.

As we propose to mold this in its entire length, a sufficient height of oven and crane, as well as depth of pit, are prime requisites. It might be that an indifference as to inside finish could be taken advantage of, and the labor on the core considerably reduced thereby. A method of molding under such circumstances will be shown, as well as a more elaborate one, in case it should be necessary to separate the parts in order to a perfect finish, inside as well as outside.

Whilst it might not, in this particular instance, be desirable to adopt a system of dry sand cores, yet changes of design might make such a course indispensable; therefore a method calculated to meet the altered circumstances will be discussed and suitably illustrated as we pursue the subject.

It would be superfluous to go through every detail connected with the molding of such a casting; therefore in dealing with this subject we shall pass over all the ordinary processes of loam molding, confining ourselves to those parts only that possess more than ordinary interest to the workman.

To those who may be unacquainted with this particular class of work it may be well to state that a quadrant of 4 feet diameter does not make a very stable structure, in loam, when built to the height of 12 feet, and some method must be devised whereby the divided core may not only be handled, but conveyed in and out of the oven, and finally to the pit for casting.

We will first consider how best to make such a mold if it were allowed to deliver the casting with no more finish to the inside webs than could be given them by reaching from the outside. Under such circumstances the cores might be built stationary on the foundation plate, but, as before said, something must be done to save the fabric from settling out of shape during the process of transit from the center to the oven and back.

Fig. 6 is a representation of such a core under course of construction after the cope has been struck and lifted away. The outside bearing is seen at *A*, and cores *B* are built a short distance up, where a break is

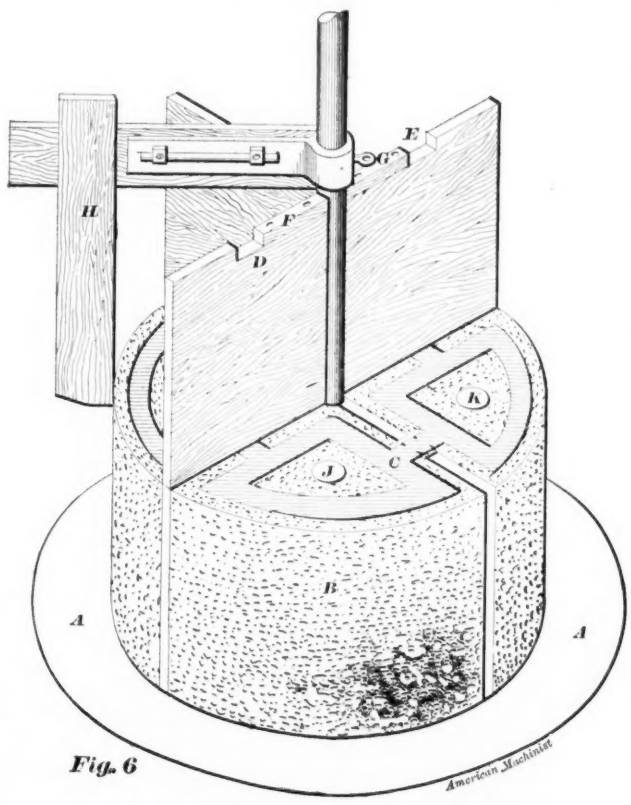


Fig. 6

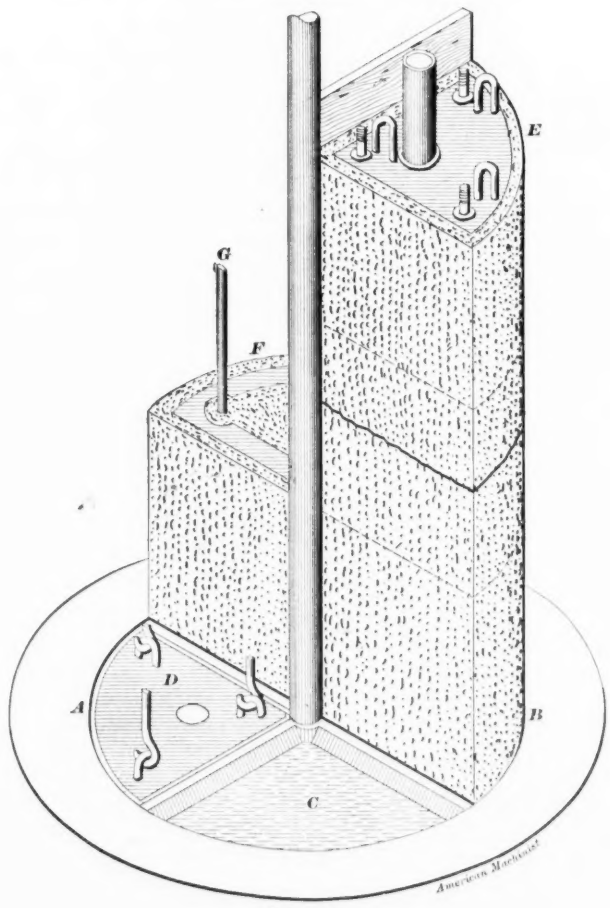


Fig. 7

made for the purpose of placing the first of four similar plates, or frames, that are to be built into the cores at intervals of 2 feet 10½", which distances would bring the last one 6" from the top. It is at once observed that the four quadrants are joined together, and form as it were a whole cast frame by allowing the connection to pass through the web at *C;* it will also be noticed that Vs are formed round the connecting piece to insure a clean break, even with the casting, when the irons are broken out.

Patterns for the webs are, in this case, made 2 feet 10½" long; eight pieces only are needed, as the under ones can be drawn when the building has reached the top edge of the upper one. It will also be seen at *C, D* and *E* that provision for the connecting web is made by cutting out a portion of the pattern, the pieces *F* and *G* being necessarily made loose and pinned, to be taken out after the web pattern has been withdrawn.

In this case the core sweep *H* need be but a few inches longer than will finish off each length of core as they are built. In building these cores have all plates 1½" clear of the casting, and be sure that the brick work is very open, well cindered, and all loam as porous as possible. The holes *J K* indicate that a short length of 4" pipe is to be used for building up to, drawing it up as the work progresses; the cindered spaces leading up to that point guarantee a sure connection at each course as they are laid.

It is important that that portion of the core plates which passes through the casting should be as free as possible from sand and blackening, otherwise they might be found loose when the irons were broken out of the cores.

In order to reach the inside for a superior finish we must lift out two opposite cores. How this may be done will be shown by the aid of Figs. 7 and 8, where the whole process is delineated in detail, cores *A* and *B*, Fig. 7, being the ones to be lifted out.

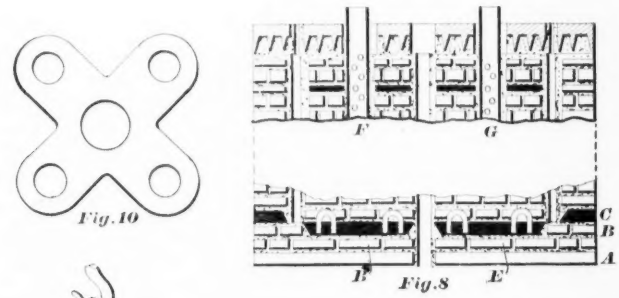


Fig. 8

Fig. 10

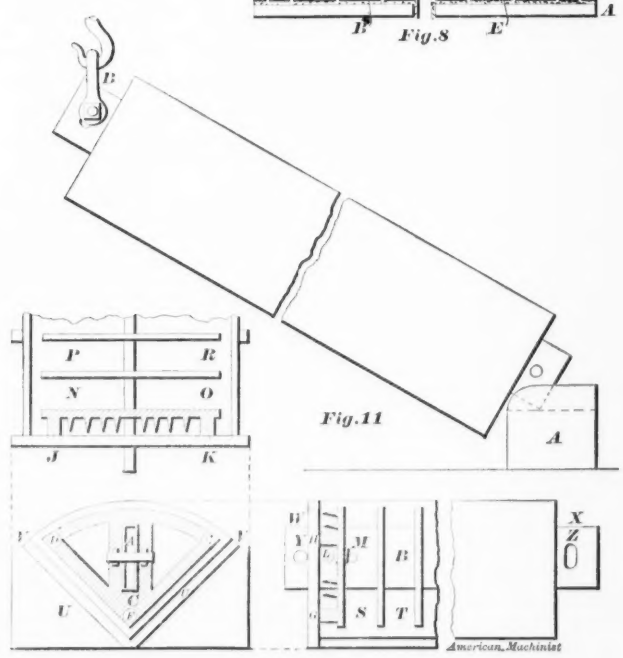


Fig. 11

Fig. 9

as the bearing for the cope ring at *B*. The bed, as formed by the plate, is shown at *C*, Fig. 7, whilst the plate in position would appear as seen at *D* in the same figure.

In this case it is best to have the web patterns made full length, set into position, and used as bearings on which to run a sweep vertically, thus obviating the use of the sweep board altogether—a thing most devoutly to be wished for when the cores are very long, as in this instance.

The webs being all set in position, place the bolts as seen at *D*, with a wedge underneath to keep them up snug, and if a template is prepared answering to the position of the bolt holes in plate at *E*, it may be lowered around the tops of the bolts and screwed fast to the webs, thus serving the double purpose of keeping the webs in place and holding the bolts in position whilst the cores are being built. For reasons obvious a four-inch perforated pipe is prepared for each of these cores, to be built in the center and stand out through the covering plate, as shown at *F* and *G*, Fig. 8, the object of this being that a plate, or cross, Fig. 10, with holes cast corresponding to the position of the pipes, may be firmly wedged around the pipes during the time that the cores are being moved about on the foundation plate. Holes cast in the covering plate through which the pipes pass, as seen at Fig. 8, can be utilized for the purpose of stiffening the whole structure after the mold is closed.

These cores are to be further strengthened by building in plates, as shown at *F*, at about three places before 6" from the top is reached, when the plate shown at *L* is to be set on as seen, and the nuts screwed down. The handling of these cores is by the three staples seen, which, when a three-legged buckle chain is used, can be easily regulated to a plumb line.

The pipes, in conjunction with the building rings, stiffen the core laterally, as well as serve the purpose of a direct medium through which the gas can pass freely away at the top. The same precautions are to be taken in this case, as in the last, to have an open built core with cinders forming a channel towards the holes in the pipe at every course.

Referring to Fig. 8 we see the foundation plate at *A;* bearing for the cope at *B;* cope ring at *C*, and the inside lifting plates with a portion of the cores built are seen at *D* and *E*. It is always preferable to have the inside plates *B* and *E* made as seen, so that their own impression forms the joint and leaves them altogether free from loam.

The manner of setting these inside plates is as follows: First, strike a bed for the bottom, lay out the quadrants, and, after cleaning and oiling the plates, set them in their exact position, opposite each other, bed them down solid, and then build on a course and strike off a little above the plates all over; this gives the bed for the ribs as well

As before explained, the cores *C* and *F* are to be stationary, consequently there will be nothing except the perforated pipe, and about six of the building plates used in their construction. The bolt *G* is shown simply to give some idea of how core *A* would appear when that height had been reached.

Of course it becomes an easy matter to

finish the inside of this mold when these opposite cores are taken away, as illustrated above.

The simplest method of making full length dry sand cores for this casting is shown at Fig. 9. To be sure in this case 8 cores, 6 feet long each, could be used effectually if it were necessary to adopt that mode of procedure, but we set out to discover a means of making them in one length, supposing that a contingency might, on some occasion, present itself, which would admit of no other solution to the difficulty.

The chief prerequisites in this case are: first, an arbor, or core iron as light as possible, and yet strong enough laterally, to stand turning up on end without springing; second, that the end bearing must be iron, and independent of the sand core; and third, that means be taken to insure a safe elevation of the core, and having the same to hang plumb for closing in the mold.

The end section and side elevation of a suitable arbor for such a core is shown at *A* and *B*, Fig. 9, the dimensions being 2″ thick and 12″ deep, on which wings *C* are to be firmly wedged, as seen at *A*. The bottom wing must be made extra strong, and must have a stud 3″ diameter cast at each corner, and when the core iron is placed in the core box these studs must rest against the bottom of the core box, as seen at *G*, *H*, *J* and *K*. These studs must be placed to correspond with bearings set upon the foundation plate, and even with the seatings formed to receive the cores; by this means the weight of the core is resting independent of the sand seating.

As seen, this bottom wing is securely held both ways by wedged pins inserted at holes *L* and *M*, provided for the purpose. Other holes, not seen, are to be used at intervals in a similar manner, with the view of distributing the weight of the core along the bar, and not depending entirely on the wedges which bind the wings to the bar.

Additional stiffness may be given to this core at the bottom by casting intermediate studs 1″ diameter on the wings at *N*, *O*, *P*, *R*, *S* and *T* as far back as is thought necessary. This core can be made readily in a box after the manner shown at *U U*, the rolling over being effected by securing a stout wood frame at *V V*, filling in with old sand and bricks, and bolting or clamping the core plate thereon, taking care to wedge between the plate and core iron at *W* and *X* before rolling over, the latter precaution being necessary when the arbor is heavy, as in this case.

Six inches of sand, rammed solid to the face, is all that would be required for a core of this description; the remaining portion, or heart of the core, can be cinders.

Once dry all is over, as the core can be safely transported by means of the holes *Y* and *Z*, the latter hole being made oblong for the purpose of regulating the swing when closing into the mold. The mode of swinging is shown at Fig. 11, and consists of a wood block *A* about 18″ square, rammed firmly in the floor for about 2½ feet, the top end of which must have a groove cut thereon nearly as deep as that portion of the arbor that extends past the end of the core, and about the thickness of the same.

The elevation of this core is easily accomplished by means of the shackle *B*, which is made to fit the arbor, and is provided with a threaded pin that precludes all possibility of the shackle spreading.

The Gage Tool Co., of Vineland, N. J., write us that they find their plane-truing device, illustrated by us week before last, to be very useful also for truing the surfaces of oil stones. By using kerosene on the sandpaper, to loosen the wood fiber that would otherwise clog up and glaze, it does this work perfectly, making the surfaces much better than when the stones are new.

A recent improvement in the device consists in so arranging the sixteen compartments or cells in the bottom that they constitute pockets for wire nails, brads, screws, etc., a cover fastened by two screws serving to hold these in place when the device is turned over for use in truing planes.

Foundry Practice with Keep's Tests.

BY W. J. KEEP, DETROIT, MICH.

If it were possible by chemical analysis to determine what change should be made in a mixture of iron to produce a desired result, such a course is expensive and slow. Cheap irons cannot be purchased on guaranteed analysis, for a furnace will not run regularly, and even the two ends of the same pig will not give the same analysis. In ordinary marketable pig-iron, phosphorus and manganese will not run over one per cent., and sulphur will run only a few hundredths. As the first two exert very little influence on foundry iron, and do not increase chill or make iron white, we may ignore their presence. It is well to purchase irons that have a good reputation. The most common element found in pig-iron and the most important is silicon. Its presence up to about three per cent. makes iron soft and gray and reduces shrinkage.

It does this by changing carbon into dark and bulky graphite, which colors the iron and makes the casting larger. Silicon is an antidote for anything that produces an opposite effect. All we have to do therefore in everyday practice is to see that silicon is present to the extent that is required.

Owing to circumstances the founder must purchase the iron that is cheapest in the market, and from it make the best castings. Iron that is low in silicon is cheap, and vice versa. We should therefore get as much silicon as possible in cheap irons. Often close-grained, light-colored No. 2 or 3 pig is higher in silicon than a more open and darker iron. For large castings silicon must be low, and for thin castings it must be high.

If chilled castings are to be made irons must be selected that have a natural tendency to chill. Such tendency is not due to ascertained chemical composition. If a founder applies "Keep's test" to a casting which is acceptable, its shrinkage, chill and strength is a standard by which to judge future work. Within certain limits, by keeping the shrinkage uniform, the castings will be uniform. As a practical application we will first present the record of tests of four brands of pig-iron, and then present the results of four mixtures of these four irons.

The grain of the center fracture of a test bar is shown by the square drawing, while the rectangular drawings represent the end of a bar with the side broken off, showing the depth of chill and the grain.

The chemical analysis of test bars of the pig-iron is given in table I.

The figures on the ends of the test bars indicate the actual chemical analysis of those bars. It was intended to have them as nearly as possible 1.50, 2.00, 2.50 and 3.00.

The original pig-iron from which 376 was made contained T. C. 2.98, of which only 0.95 was G. C. 397 is supposed to be of nearly the same composition as 401 except as to silicon.

TABLE I.

No. Test.		T. C.	Si.	P.	Mn.	S.	G. C.	C. C.
376	White Pig Iron	3.13	0 25	0.26	0 09	0.03	1.62	1.51
441	Gray Pig Iron	3.55	1.20	0 84	0.18	0.04	3 22	0.33
397	Gray Silicon Pig.....	...	4.36	...	...	....	...	...
401	Flaky Silicon Pig	1.99	10.34	0.45	0.52	w	1.92	0.07

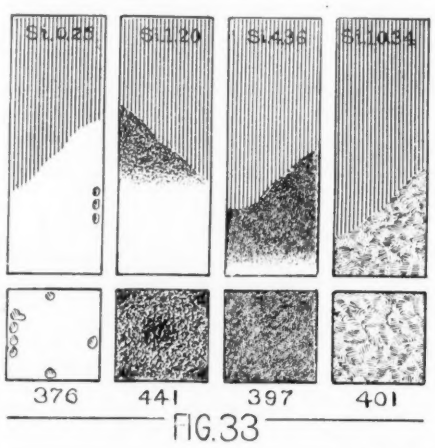


FIG. 33

TABLE II.—(FIG. 33)

No. Test.	Iron.	Dead Load.		Impact.		Shrinkage.		Hardness.	Chill.	D. L. Strongest Single Test Bar.
		Strength.	Def.	Strength.	Def.	Sq Bar.	Thin Bar.			
376	White.	379	.14	237	.16	.248	.246	100	All.	384
441	Gray	362	.27	339	.29	.168	.186	74	.40	379
397	Silvery.....	478	.25	425	.27	.139	.146	64	.10	514
401	Flaky	231	.12	125	.11	.199	.201	132	.0	245

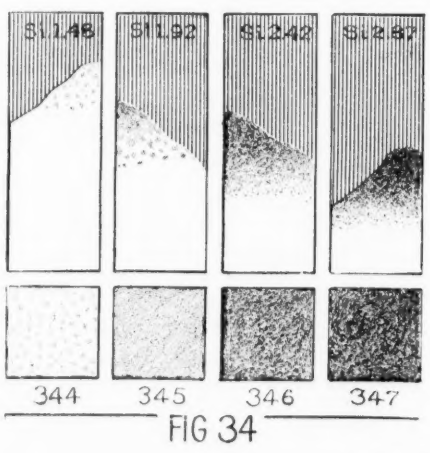


FIG 34

TABLE III—(FIG. 34).

No. Test.	Percentage. Silicon.	Dead Load.		Impact.		Shrinkage.		Hardness.	Chill.	D. L. Strongest Single Test Bar.
		Strength.	Def.	Strength.	Def.	Sq. Bar.	Thin Bar.			
344	1½ per cent. silicon.	466	.14	299	.15	.227	.243	84	All.	495
345	2 per cent. silicon.	486	.21	356	.21	.169	339	60	1.25	508
346	2½ per cent. silicon.	416	.19	362	.21	.163	.220	57	.60	432
347	3 per cent. silicon.	421	.23	451	.27	.155	.167	55	.22	469

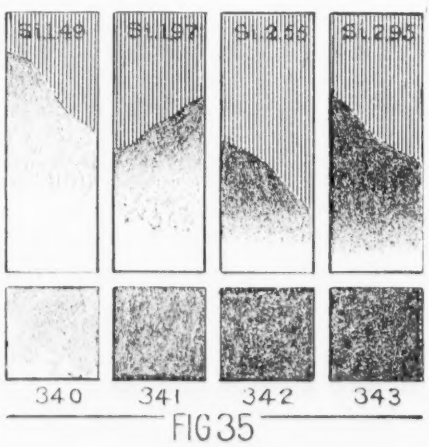


FIG 35

TABLE IV—(FIG. 35).

No. Test.	Percentage. Silicon.	Dead Load.		Impact.		Shrinkage.		Hardness.	Chill.	D. L. Strongest Single Test Bar.
		Strength.	Def.	Strength	Def.	Sq. Bar.	Thin Bar.			
340	1½ per cent. silicon.	501	.19	486	.27	.179	.243	65	1.25	540
341	2 per cent. silicon..	464	.22	390	.20	.161	.217	57	60	475
342	2½ per cent silicon.	498	.27	466	.29	.156	.161	56	.20	505
343	3 per cent. silicon..	452	.25	390	.22	.147	.160	53	.18	460

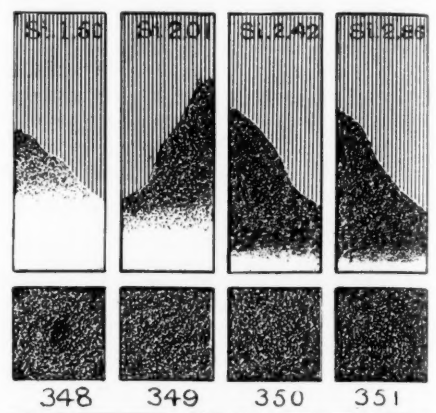


FIG.36

TABLE V—(FIG. 36).

No. Test.	Percentage. Silicon.	Dead Load.		Impact.		Shrinkage.		Hardness.	Chill.	D. L. Strongest Single Test Bar.
		Strength.	Def.	Strength.	Def.	Sq. Bar.	Thin Bar.			
348	1½ per cent. silicon	362	.23	345	.25	.162	.175	58	.40	375
349	2 per cent. silicon..	363	.23	334	.22	.156	.158	45	.22	365
350	2½ per cent silicon.	380	.28	350	.28	.143	.149	42	.10	390
351	3 per cent. silicon..	370	.26	385	.27	.134	.153	28	.08	380

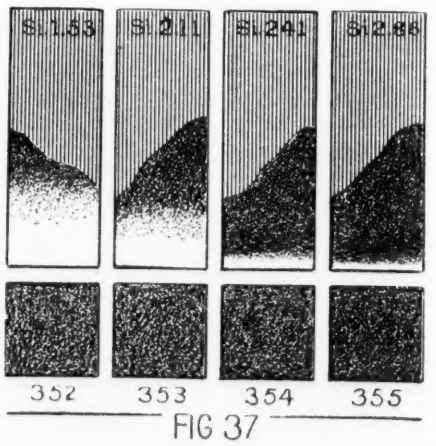


FIG 37

TABLE VI—(FIG. 37).

No. Test.	Percentage Silicon.	Dead Load.		Impact.		Shrinkage.		Hardness.	Chill.	D. L. Strongest Single Test Bar.
		Strength.	Def.	Strength	Def.	Sq. Bar.	Thin Bar.			
352	1½ per cent silicon.	365	.23	373	.29	.163	.181	54	.40	380
353	2 per cent. silicon..	348	.23	228	.23	.161	.162	50	.20	360
354	2½ per cent. silicon.	318	.24	277	.24	.141	.149	39	.07	330
355	3 per cent. silicon..	348	.30	401	.32	.148	.148	42	03	355

Fig. 33—(table II) shows the four original irons.

The following records show the results of adding to one of the two pig-irons, enough of one of the silicon irons to make test bars with 1½, 2, 2½ and 3 per cent. of silicon (actual analysis is marked on the bars). They show that the peculiarities of a pig-iron remain in the mixture, and will not be wholly eliminated by a change of chemical composition.

Fig. 34—(table III) is a mixture of white pig-iron (376) and a portion of flaky silvery iron (401).

The carbon in the white pig-iron being nearly all in the combined state, so little of 401 was used that it introduced but little of its peculiar characteristics. The introduc-

tion of silicon has formed graphite artificially, making a very fine mottled grain and a very solid casting.

Fig. 35 (table IV) is a mixture of the same white pig-iron (376) with gray silvery iron (397), which latter is made from a mixture of the same ores as 401, together with ores that alone would have made a high chilling iron. 397 would therefore carry a large percentage of silicon, making a very close black iron much like the mixture in Fig. 34 if the silicon had been carried to 4½ per cent.

By the use of a low silicon softener we were obliged to use more of it, and have therefore obtained some of its other peculiar qualities.

The silicon is more effective than in Fig. 34, it taking one-half of one per cent. less silicon than in the former case to produce a given result. The extraordinary strength of the single bars of this mixture indicates what may be done by careful selection and mixing in foundry practice. The mixtures in Figs. 34 and 35 are what would be desirable for machinery castings and indicate the use of low grade pig-iron and low silicon softeners. No. 1 pig-iron is a softener only, silicon being about 3 per cent.; it is therefore necessary to use more of it.

We found while testing samples, one white pig-iron with silicon 1.97 and shrinkage square bar 2.41, thin bar .235, dead load strength 566, deflection 19, impact 412, hardness 65, strongest bar 596, def. 20. On the other hand, we have found a white casting of substantially the same chemical composition with silicon 2.74 that was very tender.

It is a very rare thing for iron to be high in silicon and still remain white.

Fig. 36 (table V) is a mixture of the gray pig-iron (441) with the low silicon pig (397) both having some tendency to chill.

Fig. 37 (table VI) is a mixture of the gray pig-iron (441) with the high silicon softener (401) which latter has no chilling tendency.

Graphitic carbon is a weakening element, especially if the grain be coarse. We see that if we wish little chill and low shrinkage we must use pig-irons with low chill, and that shrinkages may be lowered by mixture more than can be accounted for by that of the original irons.

If softness, lack of chill and low shrinkage are of more account than great strength, gray irons will be selected. While silicon will control the whiteness yet some irons will carry more silicon than others. In our foundry the bulk of the castings are very thin, and we wish to keep the mixture uniform, and at the same time cost as little as possible.

We have no favorite pig-irons but use what non-chilling irons the market affords.

We make a set of test bars each Friday from the middle of the heat. The bars are prepared Saturday morning, and as we have more leisure we complete the test Saturday afternoon, and if necessary change the mixture Monday.

We use from four to ten different irons in our mixture, counting Nos. 1 and 2 of the same brand as a different iron.

We have found by various analyses that we need about 2.75 per cent. silicon in our castings, and would prefer absolutely no chill.

From crucible tests the average strength of the pig-irons that we use would be about 350 pounds, and the average shrinkage would be .155, and the average chill about 0.04. From these irons in the cupola we wish to get an iron with shrinkage of square bar .125, thin bar .140, and with chill about the same as the average of the pig-irons.

To give an example of our experience, when we began to test our iron several years ago, we found that it was rare to exceed 300 pounds dead load, but gradually raised the strength and at the same time found that the irons which had cost us most were not the best for us to use. We ran for the first four months of 1892 very uniformly, varying but little from shrinkage square bar .125, thin bar .142, strength 390, chill 0.03.

On account of absence during May the iron gradually changed to about square bar .150, thin bar .152, strength 370, but the castings were pronounced strong and soft by those using them. Perceiving that the mixture was not quite high enough in silicon, we made quite a change so as to increase silicon. In two days shrinkage was: square bar .130, thin bar .146, and in two more days: square bar .123, thin bar .142, strength. .396. We left this mixture practically unchanged until September 1st when shrinkage was: square bar .114, thin bar .138, strength .380. Silicon was getting a little too high. A change lessening silicon slightly brought square bar up to .126 and thin bar .141, strength 387.

We ran through to the end of the year with about: square bar .125, thin bar .143, and with D. L. strength from 370 to 450.

It was often necessary during this time to vary the mixture on account of some iron running low.

As we indicated before the kind of pig-iron used matters little if the results are satisfactory.

We have just heard that the strongest test bar from William Deering & Co.'s cupola iron thus far tested is 488 pounds Keep's test.

E. H. Mumford, foundry manager, Elizabethport, N. J., writes: The variation from day to day in a foundry product is due to variation in the fuel used and in the pig-iron.

We make daily use of Keep's test.

1st. To obtain a record of the strength, deflection, shrinkage and chill of the castings made each day.

2d. To obtain such a record of the best mixture that we have used.

3d. To give prompt notice of any tendency in the wrong direction, and to indicate what is needed to regain the highest standard of excellence.

4th. Being entirely independent of prejudice in favor or against any brands of iron the cost of a mixture may be lessened while its quality is improved.

An Unusual Foundry Experience.

Having learned that in the foundry of the A. L. Swett Iron Works, Medina, N. Y., an accident had occurred which seemed somewhat mysterious, we wrote the company for some information regarding it, our object being to give all possible publicity to the causes which may bring about injury to those employed in industrial works.

In reply, we have received from Mr. Albert L. Swett, the proprietor of the works named, a very courteous letter, giving the desired information so far as possible, for which our readers, most of whom have more or less to do with foundries, will, of course, feel grateful to him. We shall hope some of our readers may be able to throw further light on the subject, and we invite brief communications with that object in view. The essential part of Mr. Swett's letter is as follows:

We were melting a fifteen-ton heat in a newly lined cupola, and soon after the blast went on a number of our men were affected by gas. Out of about fifty employed in the room, seventeen were so overcome that it required prompt medical aid to restore them. They seemed to become paralyzed to a certain extent, and unable to help themselves. Some of them seemed to suffer intense agony, while others seemed more in a paralyzed condition. And from the statement of the doctors who handled the cases, it seemed to paralyze the lungs to such an extent that it was necessary to work rapidly in order to restore the action of the blood through the system. In about two hours or more, with the assistance of four physicians and what other help we could get, all were restored sufficiently to be taken to their homes, and the most severe cases were kept away from their work only four to five days.

As to what caused the gas to affect so many at this time is unaccountable. From actual experience of over twenty-five years in the business I have never seen nor heard of anything like it before, and in conversation with old molders, they claim they never had. The molding shop had been idle for two days. All ventilators were closed, and the gas after putting on the blast seemed to settle to the earth instead of going to the chimney. It was not our custom to open the ventilators until the room was warmed somewhat from the melted iron; doubtless the gas was all retained in the room.

I have given you the facts of the case as near as I am able. If you can make anything out of it, or if you wish to ask any further questions, shall be pleased to give you what information I can.

LETTERS FROM PRACTICAL MEN.

American vs. Imported Files.

Editor American Machinist:

Referring to an article quoted in your paper, and written by Mr. A. D. Pentz, I am rather sorry to see this going the rounds, as it is a very hard matter for the truth to catch up with a false statement, or a statement made through ignorance. If the writer of this article would call at my office, or, I think, at the office of any manufacturer of American files, he could be easily convinced that not only do the files, as regards quality of steel, rank with any of the same line of manufacture in the world, but also that there is little cause for his criticism that "the files of American manufacture are not up to the average standard of other American tools." To answer his argument regarding the quality of American files as against the English, I will quote the following few lines taken from *The Ironmonger*, the leading English hardware publication, in a letter to that paper from its Sheffield correspondent on hardware. After quite an extended review as to what the American file is doing as regards getting the market, the article goes on to say: "It may be that the story is steeper than the truth, but it certainly is the case that these files have been submitted to local manufacturers here, declared excellent in quality, and simply marvelous at the price."

How would it strike Mr. Pentz to have shown to him some letters from Sheffield manufacturers of files asking American manufacturers if they could not make up the files, ship them in the soft state, so that the Sheffield manufacturer could stamp them with his own brand, harden and put them on the market as *Sheffield* made? I have a letter of this kind in my possession which I should be most happy to show him if he desires to call at the office.

JAMES D. FOOT,
Pres. KEARNEY & FOOT CO.
102 Reade St., N. Y.

Patent Monopolies.

Editor American Machinist:

In your issue for Jan. 12 I notice reference to a letter from my old friend, J. C. Clayton, wherein he expresses an opinion that the patent system is endangered by the character of some of the monopolies which have been built up under it, and as a remedy he seems to recommend another wrong equally, if not more dangerous. The bottom of his solicitude is in a supposed popular clamor against patent rights *per se*. In this Mr. Clayton yields to a fear which is not new in history, nor has ever failed to be disastrous. It is immaterial how beneficial an institution may be, it is always easy to find those who would tear it down, and it is generally easy to institute a popular cry against it. History does not disclose any subject more liable to this precise treatment than new and labor-saving inventions. If popular clamor against the introduction of new inventions had controlled, four-fifths of this country would still have been a native wilderness, and the people would still have been in that pauper condition which we hear much about from certain classes of politicians. It is the business of the statesman to resist or turn aside by proper explanations the clamor of misguided men, and not to yield the public good for the sake of placating ignorance.

In looking at this subject, it must be considered that the constitution of the United States provides for *exclusive* grants only. Congress has no more power to legislate limited grants than it has to deprive citizens of vested rights without compensation. This is no new view; it was held so by the U. S. Senate some years ago, when a bill was before it to compel inventors to part with their patent rights. An exclusive right is necessarily a monopoly, and it is impossible to see how the magnitude of it can in any way affect the case.

A great deal of useless sympathy is expressed for those who get caught in the trap when a broad patent like the Edison lamp patent is sustained. If Edison really made the invention claimed, the benefit bestowed upon the world is, beyond calculation, more important than the private interests of those who wish to get a share of the profits, and the question is, Would anybody devote his life and fortune in devising new and important improvements under any other conditions than exclusive control? It is safe to say no. And the evidence of it is to be found in any country where patents are not granted. It is also to be found in the fact that progress in the useful arts is in proportion to the liberality of the patent laws, and in the further fact that this is becoming generally recognized, and in other countries the movement is toward patent laws modeled on those of the United States.

It must also be considered that usually it is not one inventor only who is devoting himself to study along a certain line, but usually there is a large number, and while it may not be a race for success, nevertheless, in the nature of things, one will hit the mark nearer the center than all the rest. To him will go the prize. If the target were the head of a turkey, no one whose bullet did not touch would claim a piece. Why should unsuccessful rivals claim a share of the successful invention, merely because it is more valuable than many turkeys, and because they tried to hit it?

Those who are caught in the infringement trap knew the trap was there. They merely thought they could get the bait without getting caught, and took chances with their eyes open. They suffer for mistaking their power to deprive some one of what the law gives him.

Mr. Clayton's remedy—liberal rulings in courts of equity—is a remedy worse than the disease. For a court to transfer rights from the lawful possessor to an unlawful claimant, with an expectation that good would come of it, would simply open the door to the most nefarious outrages in the name of justice, and would speedily bring ruin upon the whole system. There is altogether too much law making by the courts already—do not let us suggest or encourage it to still greater lengths.

In the case of the telephone the courts are to blame, and not the law. That monopoly has been built and sustained solely by connivance of the courts. It nominally rests upon a patent which does not even hint at the thing which it protects—a pretension which has for years past been repudiated by every disinterested expert in the world.

There is also a great deal of nonsense from those who think the patentee ought to give something for nothing. The man who wants a husking pin wants it at the bare cost of the iron or a little less, and he abuses the patentee if he does not have what he desires. He ignores the fact that he need not buy it if he does not choose, nor the other more important fact that, whatever might be the desire or necessity of the patentee, he would not buy it if he did not himself realize a profit by doing so. If he makes money himself by buying it, why need he inquire whether some one else makes more or less by selling it? It is worth a premium to have the thing, and without the premium for a while the thing will not be produced. No farmer is compelled to use a mowing machine or a reaper. He can still cut his grass with a scythe, or his grain with a sickle, as I saw farmers doing in Canada last summer. But between the sickle and the reaper there is a large margin of profit. The inventor has created that profit; why should the farmer grumble at a share of it and demand the whole? Theologians tell us the earth and all that is in it *belongs* to the Lord, *because He created it*. Why should not the invention belong to the creator of it? R. D. O. SMITH.

Smoke Prevention.

Editor American Machinist:

Mr. Odell's remarks are to the point.

Smoke prevention has somehow got to be looked upon as a sort of second-rate occu-

pation. This is not because, properly carried out, there is not a good deal of science in it, but rather that it afforded at one time a field of prey for a number of men who were not over-nice as to their claims, and would guarantee anything. At the same time, the class amongst steam users of which Mr. Odell so feelingly speaks, does undoubtedly exist, and does not hesitate to demand of a poor preventer an entire reinstatement of their steam plant, should anything occur during his presence in the locality, which can be construed as due to his enchantments.

I well remember, too, a certain preventer who would take your order for $100 per boiler, and in a few days come along with half a cartload of fire-brick lumps, and put these somewhere back of the grate, where, when other conditions happened to be present, they really did not effect their object. When I last heard of him, he had retired to the seaside to live on the proceeds, but he has considerately left the smoke behind him for others to go and do likewise, and I see already a new affair somewhat on the same principles, but better arranged, is having a fine boom. Once in a weak moment I was tempted to assist a smoke prevention crank with a device which involved new bars. He got rid of quite a good number of these, and, as they did not cost much more than an ordinary set of bars, this was not very difficult, and indeed it ought not to have been very difficult, for after I had footed the bills for material, traveling expenses, etc., and began to ask about the returns, I discovered that all that had been sold had been given away on trial, and "would we please remove them if worth our while." As the bills for liquid refreshments had appeared a trifle heavy, and Mr. Preventer himself fell into the river, owing to the darkness, I decided not to encourage late hours any longer, and so the people kept their bars, and I kept the remainder of my money. These little items exercise a distinctly discouraging effect, and doubtless have much to do with discouraging steam users, who begin to look on the smoke fiend with an eye of hate and distrust. At the same time, much may be done if all about the place really mean business. One of the worst hindrances to success in this country is a hateful institution known as coal money, coal money being neither more nor less than a payment made by the coal merchant to the firemen of the places he supplies with fuel. I have known the threatened reduction of a wasteful engine fought against because of the consequent reduction of coal money which is paid on the amount burned, and is an incentive to carelessness. The steam user knows perfectly well that the payment is made, and perhaps oftener than not it is not allowed by the fireman to make any difference, for I have observed that the observance of honesty is more marked amongst the more moderately paid of this world than amongst the wealthy. Then again the manner of enforcing the smoke prevention acts is not marked by either wisdom or justice. The inspectors are men who know nothing of the facts of combustion. Some friends of mine in the North were experimenting with a new device to prevent smoke, and, of course, during their tests made a little more than usual. They had written to the smoke department and explained matters, and the only assistance they obtained from the chief fool was that an inspector was set to watch, and my friends were reported. At the same time a neighboring firm who, to use a euphemism, dealt in "palm oil" with the inspector, never were reported, and were always smoking. My contention is that the City Smoke Department should be in charge of an engineer, and the inspectors should not be merely men of no knowledge, for such inspections as are made could be made by any sharp-sighted boy to watch the chimneys. Smoke regulation should be carried out for the public benefit, and it is not for the public benefit that power users should be foolishly harassed out of a town, leaving their workers stranded out of employment. One result of this idiotic system is that firemen retaliate in the only way they can. On a misty day, or a cloudy morning or evening, they turn out volumes of smoke willfully, and in this high latitude it is dark in winter until 8 A. M. and before 4 P. M., but it is risky making smoke in daylight, even when the fog hides the chimney top, for a fog is often but a few yards thick, and by going up a tower one can get above it and see the chimneys sticking up out of the fog. I feel inclined to ask you to send a copy of the American Machinist, with this in it, to the Department of Nuisances, at ———. Anyhow, I hope they will see it, as it will afford them a glimpse into the opinion of them which is held by others than myself.

From Mr. Odell's description of his own apparatus, I should say he did just about the right thing. Had his clients gone along with it, they could probably have cut out one boiler and added a flue-feed heater as an extension of the heating surface.

In burning liquid fuel there will be a good deal of smoke made, and this may be cut off, as with a knife, by an air injector worked by steam—taking care, by the way, to use steam as dry as possible, and not in too great a quantity. The interest in Mr. Sennett's paper to me lay in the special stress which he gave to the importance of steam, and hence my notice of it, as I had myself looked on the steam jet rather as a very convenient motive power than as a necessary ingredient. In fact, I think it probable I should have left out the steam jet in a case where I could have had a supply of air in its place from say an air-compressing plant. I believe smoke can be prevented every time if a little experimenting be done to ascertain the idiosyncrasies of each case, but this takes time, and the man to do it is the engineer in charge, who ought first to understand the general principles, and then apply them himself, than whom no one ought to be better fitted. I must tell Mr. Odell I know very little of American bituminous coals, but judge them, from all I can gather, to be very similar to our own, only more so; but I thought a record of English practice in this difficulty would be of interest. There seems very little difference in the experiences of Mr. Odell and those I have heard related by his fellow-sufferers here.

About a year ago I wrote you a letter concerning a new steam engine (see American Machinist, Jan. 14, 1892). This new engine was to revolutionize everything, and it had the first necessary revolutionizing adjunct, for it was in the hands of a "syndicate." What the world would do without its syndicates it is impossible to say. However, the world has had to do without the engine, for it has not yet begun to revolute even itself. "Difficulties have arisen .... which make it necessary, etc., to delay matters," and so on, the usual excuses in such revolutionary affairs. I have a friend who holds stock in it; he had better have come to me first, but did not do so. The only satisfaction I have for being $100 short of the fee for advice is that he was heard to say that he had "begun to think Booth was right"; for he heard when too late what I had said about his pet. W. H. Booth.

Some Short Rules.

Editor American Machinist:

I have found it frequently of great advantage to formulate short rules for some of the simpler questions arising almost daily in shop practice, to avoid the constant use of the figuring pad and books of reference, and, as they may be useful to your readers, I take the liberty of submitting one or two. To obtain horse-power of any engine assume 42 pounds M. E. P. and 500 feet piston speed, then half the square of cylinder diameter will equal H. P. very closely. Or, more closely, diameter cylinder squared multiplied by pressure (M. E.) and piston speed divided by 42,000 = H. P. These are accurate within a small fraction of one per cent., and frequently enable me to give quick replies, without pencil and paper. A quick and accurate rule to find cubic gallons in a cylinder is, multiply diameter squared by .0034. Result will be gallons per inch in height.

I have lately had some puzzling questions regarding the driving power of belts, both slack and under tightener, and have now deduced a short rule that seems to be in consonance with the book rules and the observations of my own experience, and would like your opinion as to its accuracy and applicability.

I find that to transmit a horse-power by belt requires 550 square feet of belt contact per minute without the use of a tightener, while with a tightener the same work may be done with 400 square feet. The rule is simple and easily remembered, and can be applied by any one who knows the multiplication table. H. R. Barnhurst.

The Apprentices of England and America.

Editor American Machinist:

Why are English apprentices better mechanics than the Americans? The Englishman would answer, "That is a very foolish question. Don't the English boy go to whatever trade he selects or wishes to learn when he is about 14 years of age, and work day after day without any vacation for seven successive years, and obey every call of the foreman, work hard, and try to get along to the best of his ability? His father binds him over to the firm until he is twenty-one years of age; he has not a shadow of a chance to escape and go to some other shop for more money; he has given seven years of his life to the firm for them to make a mechanic out of him; now how would it be *possible* for him to be anything but an *expert* at his business?"

The American young man does not think anything about mechanics, but goes to school until he is 16 or 17 years of age, and when he graduates from the public school his father (who is a mechanic) is worried to know what to do with him, as he cannot afford to educate him for a doctor or lawyer. However, it is finally decided that he will learn pattern making, for instance, and he settles down to business for three or four years. It makes him feel very uneasy to think about the time—three years is such a terribly long time. The foreman puts him on a bench and gives him a drawing with the necessary explanations. He has been looking at the drawing now for more than two hours, and as the foreman has gone out, he is all but crazed. However, there is a young man there in his last year who feels a little interested in the new apprentice, and takes pity on him, and they finally make the pattern between them. At the shop where he is they have all the latest machines, and he soon learns to use them all to perfection, because he finds out that it saves more than half the labor. "Now considering the few years he has to learn in, and all the machines that he uses, *what does he know* about his trade when he is through? There is too much machine work and too little time." This is the Englishman's version.

The English boy is bound over to the firm for the full seven years, and he knows all about it; the foreman cannot discharge him if he loafs at his work; he settles down the first two years, sweeping the shop and painting patterns. The shop is always dirty, and it takes such a long time to reach the other end that it is not necessary for him to hurry himself, for he will only have to do it over again to-morrow. The apprentice is supposed to always have a large drawer partitioned off into spaces, and filled with core prints of all sizes in round and square; but not one, either round, square, or the correct size, is ever to be found in the drawer. These core prints are for the pattern maker to use on the patterns he makes, so as to save time, but never being able to find two alike, he decides to make his own core prints. The apprentice becomes discouraged cleaning up the shop after a while, and wants a bench to learn pattern making. He has made up his mind not to do dirty work all his time and makes complaints to the men, but they cannot help him; he must follow the old routine. The third year he saws lumber out by hand for the men; it is very seldom they have a band or circular saw; there is a lathe on a wooden frame that they could not get along without. The apprentice will have to saw out segments for the men with an ordinary bow saw, which he gets to be expert at. There is still four years more of his time left to finish, and he has learned to take things easy, and has got into the slippery ways of the shop. The apprentice now gets his first drawing, but does not understand it. He was a good ordinary scholar when he entered the shop, but has forgotten most of that; he has now been in the shop three years, and has lost more than he has gained.

It is impossible to compare the American boy with the English boy, for the American is a good scholar, and has no slouchy ways about him; he starts in for three or four years to learn his trade, and starts with a will.

The Englishman comes out of his time an ordinary slow workman. The American is a neat and clean workman, and has learned to use all the machines in the shop, so in taking another position he is unlike the English apprentice, emigrating to this country with no knowledge of machines whatever, finds it impossible to get along on the same standing as the American. I do not want to give the impression that the Englishman doesn't make a good mechanic; if he comes to this country when he is through with his apprenticeship, and if he is smart at all, he will get along as well as any after he has had a year or two of good American training.

My experience as an apprentice in one of the best shops in England is that an American workman does twice the amount of work, and a great deal better work than a foreigner will do. I have found from experience the difference in workmanship on two patterns made from the same drawing by two different men, to be almost impossible to believe the two to be the same. The finish of one compared with the other was a work of art. It is impossible for the draftsman to make a drawing to show the nicety of the machine or the clear cut of the casting. The beauty of the finished machine comes from the first-class pattern maker with his fine touch, and the interest he takes in the work. The draftsman will see his machine finished, where the patterns are made by a poor workman, and although everything shall measure as correctly as he made the drawing, still there is something wanting, and the designer is not satisfied. The apprentice should be followed closely to see that he puts the right finish on everything he does, for it is the most easy thing in the world to become a slouch, and three years of careless training will take nine years to knock out of them, and by that time the man is getting too old and set in his ways to learn; he has had twelve years experience, and feels he knows it all, and that settles it. When I speak of the American apprentice I mean any young man educated in this country or American by birth. There are few Americans of two generations who would *lower* themselves in their own estimation to learn any mechanical trade; they would rather be clerks in dry goods stores, or in the office as shipping clerks; it is nice to talk with the customers and to be your own *boss*, and show your employers how a business ought to be run. The clerks don't think about the mechanic getting twice the salary, but look upon him as a dirty workman, while they dress up on week days in their Sunday clothes.

How much better it would be for the American young man to learn to do something for himself and country in the way of manufacturing something that would be a credit to him. I fail to see anything to be proud of in being behind a counter selling something of foreign manufacture. There are thousands of machines manufactured abroad that they say we cannot make and must have, and if the young American will lay off his best clothes and come and help, we can manufacture better and more in the same time, and let the foreign manufacturers put their wares in another market, and give them a chance to look at us and see what Yankee wit and skill can do. Americans are good *blowers*, and they have lots to blow about.

An English American Citizen.

Graphite and Asbestos for Packing.

Editor American Machinist:

Having a large number of flange joints to overhaul and re-make in steam pipes within the last two years, I have experimented considerable with sheet asbestos.

Some engineers prefer to use this material dry and some prefer it saturated with water, and yet others think there is nothing like asbestos soaked in linseed oil.

Applying the asbestos dry makes a very good joint while it lasts, which is from three to five months. On breaking such a joint I find the material from the bolt-holes to the inside edge of the flange very soft and mushy, the steam easily penetrating it and passing out around the bolts, while from the bolt-holes to the outer edge of the flange it is firm and in good condition to hold much longer.

Asbestos thoroughly saturated with water makes quite as good a joint as dry material and lasts much longer, but finally succumbs to the same influence that destroys the material which is applied in a dry state.

I had one special joint that gave me considerable trouble; in fact, I made it so often that I began to despair of ever getting it to hold. The joint in question is in an eight-inch steam pipe immediately over the engine, the most annoying place to have a leaky joint, especially when it is desired to keep an engine looking nice. The longest I could get this joint to hold was two or three days at the most, when water would begin to drip from the bolts, gradually growing worse until re-made. The material was used dry and saturated with water, likewise linseed oil, but all to no purpose.

Being a fanatic on the usefulness of graphite, and having a large quantity of graphite paint on hand, I thought to try saturating asbestos with this paint. This has been about four months ago, and that joint is yet as tight and firm as the iron itself and shows no signs of giving way. The graphite paint being slow to penetrate the asbestos, the gasket was split into as many gaskets as possible without breaking them. In this way plenty of paint was gotten into the joint.

Since making that joint as above described, I have made about twenty joints in the same manner, and not a single one has shown any signs of giving out.

While on the subject of asbestos and graphite, I want to tell you that the best packing for valve stems that I ever used is asbestos roping and dry graphite, and to properly apply it, according to my experience, first make the roping the proper size, then thoroughly saturate it with water, then ring all the water out that is possible without injuring the material, then wallow it in dry graphite until no more will adhere to it, and it is ready to use.

I have tried cylinder oil instead of water, but abandoned that way, as the packing thus treated soon gets hard and is not as pliable as that saturated with water.

S. A. SMITH.

Heating by Exhaust Steam—Setting Valves.

Editor American Machinist:

It is a good thing to be in touch with intelligent mechanics through the AMERICAN MACHINIST. When in doubt as to the desirability of making a collapsing piston valve, or an adjustable solid piston, a hint in the paper is sure to bring somebody to one's relief.

To be sure we do not always get a response from those we would like best to hear from, but a reply from some source can be confidently counted upon. Thankful for small favors I am still unsatisfied with the sparseness of the information my inquiries elicited.

I would like to hear from older and more experienced mechanics as to the wisdom of making solid adjustable pistons and collapsing adjustable piston valves.

It seems to me they would both be good things to have. If they are not, I wish some one who really knows would tell me, and tell me *why*.

I am inclined to make an attempt in that direction, but hesitate, for fear my effort will only result in depletion of capital.

I coincide with your correspondent, Mr. W. E. Crane, in regard to check valves. Passing through the engine room of our laboratory the other day I saw Michael rapping on the check valve in the feed pipe between the injector and boiler. He claimed that the check would not seat, and the injector would not work without this encouragement. An examination showed that the lift of the valve was excessive. A spiral spring above the valve cured the difficulty.

Incidentally, a proof that an automatic cut-off engine is more economical in the use of steam is seen in our laboratory.

The building is heated by the exhaust from an automatic cut-off engine.

It not being necessary to run the shafting all the time, it is customary to throw off the belt and run the engine light for the sake of the heat.

It is found that by throttling the steam we get more heat at the same or less speed. This seems to indicate that the throttling process uses more steam to do the same business.

In adjusting an engine to its work a pretty good way seems to be to vary the lead back and forth until the engine runs at its smoothest, and then "equalize" the cut-off until the belt runs straight. This can all be done in the back woods, miles from an indicator. If by chance an indicator is to be had it would do no harm to take a card *after the valve is adjusted*, and then boldly claim that that is the kind of a card an engine ought to make.

I recall a case where an indicator expert had come a long way at considerable expense to adjust an engine. He succeeded in making beautiful cards, but the engine thumped fearfully. He claimed the valve was set right because the indicator said so.

The shaft was not round; he said that will come all right in a few days.

At the end of a week, there being no improvement, one of these back-woods valve setters was called to remedy the evil.

He hung around the place all forenoon, and while all were gone to dinner quietly slacked the eccentric and rolled it back by guess, and went away—as the proprietor thought—without "fixing" the engine. After dinner—and ever since—the engine has run smoothly.

Next day the proprietor met the valve setter and told him he need not come, as the engine was running all right.

But still the indicator is a good thing to take cards from a successful running engine.

That square upper corner costs too much.

I never could see the sense of cracking on steam anywhere within the "angle of repose," where you can get no rotative effect.

BENJ. F. WILSON.

Key Formulas.

Editor American Machinist:

I was very much interested in "Chip's" letter in Jan. 5th issue regarding standard keyways, and as I felt the need of a standard for keyways, I made a sort of an elastic formula whereby a table could be made, and probably it may be of some benefit to some of the many readers of the AMERICAN MACHINIST. I send it in.

FORMULA FOR STANDARD KEYWAYS.

$$\frac{\text{Dia. of shaft}}{4} = \text{width of key;}$$

$$\frac{\text{Width of key}}{4} = \text{depth in shaft.}$$

$$\frac{\text{Width of key}}{2} = \text{depth in hub.}$$

Depth in shaft + depth in hub = thickness of key at large end.

Taper $\frac{A}{16}$" in 1 ft.

I always use the nearest 32d where the decimal does not come out even.

I. N. BRIGHAM.

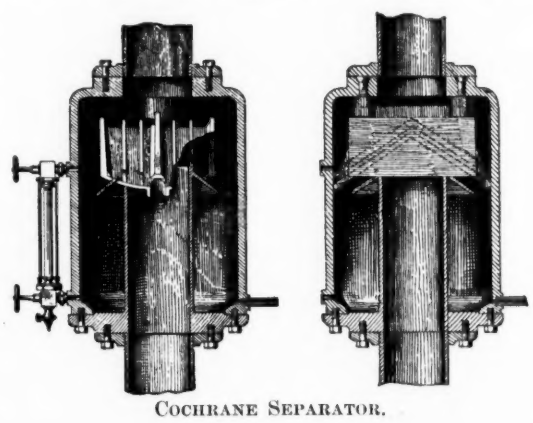
Vertical Form of Cochrane Separator.

In our issue of June 30th, 1892, we illustrated a form of the Cochrane separator upon which the present form, as shown by the accompanying engravings, is an improvement and is arranged to stand vertically.

The two sections are made from different points of view to more clearly show the construction.

The angular baffle plate with its ribbed upper and lower faces is designed to receive the impact either of an ascending or a descending current of steam, diverting the separated particles to the side, away from the passage for the purified current. The pipe projecting upwards in the separator is virtually a continuation of the main line and forms the receptacle or well for the separated particles—water, oil, grease, grit, etc. The umbrella-shaped projection at the top of this pipe is designed to contract the mouth of the well so as to prevent interference with the contents thereof. The general construction is similar to that previously described. The Harrison Safety Boiler Works, Germantown Junction, Philadelphia, Pa., are the manufacturers.

A correspondent writes to inquire where he can get definite and reliable information regarding the cleaning of castings by the sand blast method, and its cost and general practicability as compared with the usual method of cleaning by vitriol. If any of our readers have had experience in cleaning castings by the sand blast process, we and our readers would be glad to hear from them.



COCHRANE SEPARATOR.

Werner von Siemens.

BY CLARK DOOLEY.

Dr. Ernst Werner von Siemens, the highest type of the German technical investigator, inventor and tenacious student, died Dec. 6th, 1892. He was then engaged in building an electric railway in Berlin, and had just completed his memoirs. He was born at Lenthe, near Hanover, Dec. 13th, 1816, the eldest of three brothers with brilliant scientific careers, was educated at Lübeck Gymnasium, entered the artillery service in 1834, and went afoot to Berlin to pass three years (1835–38) in the military schools. His talents attracted attention and gained him the rank of lieutenant, whereupon he diligently pursued his studies in chemistry and physical science, and invented the process of electro-gilding while imprisoned for acting as second in a duel. He and his brother Wilhelm patented a differential regulator in 1842. In 1844 he began to give close attention to electro-technics in the artillery workshops in Berlin, and one of the results was his dial and printing telegraph instrument on the self-breaking principle of the Neef's hammer.

Being on the Prussian General Staff in 1847, he invented subterranean conductors, insulated by gutta-percha, for the introduction of the electric in place of the optical telegraph, devising for the purpose the first gutta-percha press. In the following year he succeeded, with Prof. Himly, in laying the first submarine mines with electric ignition, which protected Kiel from bombardment, and the same year laid the first great subterranean and overland line in Germany between Berlin and Frankfort-on-the-Main. In 1850 he left the government service, constructing telegraph lines in Germany and all over Russia and six ocean cables, and inventing a means of measuring, by electric sparks, a projectile's flight to the millionth part of a second, and a method of measuring the speed of currents in overland lines.

The world-renowned firm of Siemens & Halske had been established to bring into practical application the results of Siemens' inventive genius and Halske's mechanical talents, the firm erecting the first automatic fire telegraphs in Berlin in 1857, constructing the first pneumatic tubes, and Siemens' and Halske's block system, still in use on many railways on the Continent, and an electric railway in Berlin (in 1879). Siemens also invented dynamo-electric machines, published a work on the theory of laying and testing submarine cables, contributed to periodicals, gave lectures; was an honorary member of numerous scientific societies, received a patent of nobility, was a member of Parliament and a Doctor of the University of Berlin. He also invented automatic fast-speed writers and (contemporaneous with Fritschen) simultaneous transmission in opposite directions, and multiplex transmission by means of electro-magnetic apparatus, the Siemens' armature relay, electrical log, etc. Gun-cotton was also the product of his marvelous inventive genius, and he was the first to employ petroleum for fuel. The Siemens house has recently opened a branch in this country. Siemens had to conquer favor with the government, and will ever be an example of the way in which genius, reinforced by unswerving will, may overcome all obstacles and finally attain to merited recognition and enduring renown.

Boilers at the World's Columbian Exposition.

Quite serious trouble and delay in the work has resulted from a misunderstanding between the officials of the World's Columbian Exposition and the Babcock & Wilcox Co. The bone of contention is, What boiler company shall furnish the three boilers for the space remaining in the west end of the boiler house proper, next to the five Babcock & Wilcox boilers already under way?

The Council of Administration have recently awarded the space to the Stirling Boiler Co. The Babcock & Wilcox Co. claim that the space belongs to them by virtue of an agreement, by which all additional power was to be supplied by the six boiler companies which made the original contract, the allotment to be decided among the companies themselves. The Council of Administration denies that any such agreement was made, and claims the privilege of alloting the space to whomever it may choose.

To fortify their position, the Babcock & Wilcox Co. have obtained a temporary injunction, restraining the Stirling people from using the space. This injunction is now being contested. The Stirling Company have a large amount of material already on the ground awaiting the decision of the court.

Mr. Frederic Sargent, the mechanical and electrical engineer for the Exposition, returned the 15th inst. from an Eastern trip in the interests of the Fair. He secured three additional boilers for the power plant. These boilers will be furnished by the Climax Boiler Co., of New York, and will aggregate 2,000 horse-power—two 500 horse-power, and one 1,000 horse-power. They will be placed in the boiler house extension. They are of the vertical tubular type, and will carry 125 pounds steam pressure—the same as the other boilers carry. In fact, the setting and piping will be laid out on the same general plan as heretofore followed.

These new boilers will be connected with the system already placed, by an equalizing pipe, thus subjecting all boilers and piping to a perfectly uniform pressure. Though the time seems very short, these boilers will be installed and ready for operation in time for the opening of the Fair.

Jackson Park, Jan. 26, 1893.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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Keep's Tests of Cast-iron.

On another page of this issue we publish the fourth and final article of Mr. Keep's series describing his tests of foundry irons, with some of the results obtained by adopting the system and experimenting in the light thus gained. Much has previously been written regarding this system of tests, and it has attracted a great deal of attention in Europe as well as in this country, but this is the first detailed and complete presentation of the matter in such form as to be taken up by practical foundrymen.

Both the main idea upon which the test is founded and the method of working out the problem are entirely original with Mr. Keep, who has devoted a great deal of study and hard work to them—study and work which he has enjoyed doing, however, for he is one of those enthusiastic students who, no matter what burdens may be laid upon them, find their recreation in the study of something connected with their work. In his position at the head of the largest stove manufacturing establishment in the world, Mr. Keep has had exceptional opportunities for knowing what is required, what is superfluous or impracticable, and what can be actually made to work in the hands of practical foundrymen.

With any material, such as wrought-iron, wrought-steel, etc., a small sample cut from a larger piece may be said to have very nearly, if not exactly the same properties and characteristics as the larger piece from which it is taken, and when tested, either chemically or physically, it is generally and properly taken to fairly represent the larger piece. With castings, however, the case is entirely different, as every practical man knows that different portions of the same casting may differ essentially from each other in strength and in other respects, while a small casting, though poured from the same ladle as a larger one, will in all probability give no direct indication of what the larger casting may be in important particulars. Knowing this, Mr. Keep has abandoned the attempt to establish a direct relation between the strength and other characteristics of castings and of test pieces, and has substituted therefor a system of testing which is entirely relative, but by which every test made in any foundry will be alike. The relation, then, which can be established between the results of these tests and the strength, etc., of castings, is simply that experience will show what an iron must stand by Keep's test in order to be suitable for certain purposes, and the record of any "Keep's test" made anywhere or by any one will be as useful as any other by the same system, which cannot be said of other methods, even in testing wrought metals, much less when dealing with castings.

Of course, it is much to be desired that some plan might be adopted by which a test-piece casting would indicate exactly and directly the physical qualities of a casting of the same metal; but no method of doing this has been devised or seems likely to be. Mr. Keep's plan is, therefore, presented as the next best thing and the best practicable test.

Any one who has investigated the subject of testing at all must agree that some of the difficulties encountered in such work are very cleverly overcome by Mr. Keep, and the method by which he secures an autographic record, or, in other words, makes the machines themselves write a record of just what is being done during a test is a very valuable feature.

There is nothing in this matter which any intelligent foundryman cannot readily understand if he only wills to do it, and it is doubtful if any foundryman or other person responsible for the work of a foundry can now be considered well posted unless he does understand the principles involved in this system.

The articles as they stand are, of course, subject to criticisms, favorable or unfavorable, from foundrymen or others who may be interested, and we shall endeavor to find room for all such criticisms.

Taxation of Manufactures in New York.

A joint committee of the New York State Senate and Assembly, appointed to consider the question of State taxation, have made some recommendations that are of special interest to manufacturers and mechanics in New York, and elsewhere as well. What seems one of the most important parts of their report is that which favors local option in matters of taxation for State purposes. That is to say, the people of a certain county of the State, having a certain amount of money to raise and pay to the State as their share of the expense of maintaining the State government, shall be allowed to raise this money in any way which seems to them to be best, without reference to the method pursued in any other county.

Thus, if the citizens of any county think they have too many dogs of low degree, they can impose a special tax upon dogs, which will cause all those not worth the tax to be killed or given to the residents of adjoining counties, while the taxes paid upon the remainder will defray the county's share of the State tax.

In like manner those counties which prefer vacant lots and unimproved ground to manufactories and dwelling houses of workingmen can go on trying to tax these latter out of existence, while they allow the speculator in lots, the obstructionist whose only effort is to increase the price that men must pay for the privilege of working and doing business, to practically escape taxation on the absurd plea that his property is unproductive, as though men should be encouraged in making land or city lots unproductive, while those who use them in the production of something useful, whether corn, wheat or machinery, should bear the full burden of taxation.

There may be supposed to be counties in the State where the majority of the people are educated beyond this, and if so it will certainly affect no one but themselves if they raise their taxes in accordance with their enlightenment, while the different methods thus adopted might by actual experience show the best methods of taxation—whether it is best, as most farmers seem to believe, to try to tax personal property fully, or whether it is better to concentrate taxation upon real estate, or upon land values, which many, especially those who live in cities, think will best equalize the burdens of taxation and at the same time tend most toward the encouragement of useful labor and enterprise.

A bill has been introduced in the New York State Assembly intended to give the people of counties and of cities full power to settle these matters for themselves in regard to all except State taxes, and the discussion of economic questions, which would be caused by the passage of such a law, could hardly fail to be beneficial. Manufacturers and mechanics are necessarily interested in these questions, and in any locality where discussion of them may be going on they are worthy of attention, and the voices of men of affairs—men who are engaged in useful occupations—should be heard in regard to them, it being pretty certain that whatever changes in the method of levying taxes may be made that will be of benefit to the manufacturer will be beneficial also to all others who are doing anything to earn an honest living.

For ponderous bombastry, "A. B. Salom," who usually graces the first page of the *Iron Industry Gazette*, easily stands at the head of American writers. His latest tirade is a defense of the career and methods of Jay Gould, and abuse of those who have criticised him, in which tirade he gives no evidence whatever of knowing anything of the real nature of Gould's operations, nor appreciation of the motives which cause such a career to be condemned by editors who have some appreciation of their duty towards the public. The burden of his defense of Gould is, that he did not invent speculation, nor Black Friday; that he only succeeded in doing what others tried and failed to do; that he never was convicted and put in penitentiary, and, therefore, could not have deserved to be; that his domestic life was unexceptionable. For these reasons those who have attempted to point out the difference between such a life as Gould's, and that of a Peter Cooper, a Corliss, and others who have earned their money, are abused and misrepresented. "Absalom" has given abundance of evidence for a year or more of being what is perhaps vulgarly but expressively called a "jawsmith," and the intelligence of the iron industry is but poorly represented by his effusions.

It is reported that the captain of the "Teutonic," something of whose methods in making records of days' runs was shown by Mr. Geo. B. Grant in our issue of Sept. 1, 1892, has been relieved of his command, the action of the company being intended to be a discouragement of such methods. There are other steamship companies running other transatlantic ships that might profitably look into this matter of days' runs and gambling upon them. An engineer of our acquaintance reports that, during a trip made by him, the money won on the days' runs during the entire trip went to different members of the same family, which family were apparently and significantly upon familiar terms with the captain.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(51) S. R. H., Bridgeton, N. J., writes: Please inform me if there is a mathematical cyclopedia treating principally on machinery, and where can I obtain it. *A.*—"Appleton's Cyclopedia of Applied Mechanics," published by D. Appleton & Co., New York; "Spon's Dictionary of Engineering," published by E. Spon & Co., 12 Cortlandt street, New York; "Knight's New Mechanical Dictionary," published by Houghton, Mifflin & Co., Cambridge, Mass., besides several other works of the same character.

(52) L. R. T., Penn Yan, N. Y., writes: Assuming that I have a single-acting engine with cylinder 5 inches diameter, stroke 8 inches, piston making say 500 strokes or more a minute, and steam pressure varying from 50 to 250 pounds per square inch. Now if the valve cuts off steam at one-eighth of the stroke will the steam lose its pressure and heat sufficiently so that a condenser can handle it? Or how many units of heat at most will a condenser handle? *A.*—A condenser can always be designed to condense nearly all the steam that is put into it. There is no difficulty in making a condenser suitable for the work you mention, providing the locality affords plenty of cold water required for condensation.

(53) W. G., Philadelphia, Pa., writes: Two positions as assistant draftsman have been offered to me. I am a machinist and receive from $15 to $16 per week. I have taken a full course at the Franklin Institute, and understand algebra and geometry fairly well and have had experience in drafting. My parents do not like me to leave home, and they believe that I cannot do better at drafting than as a machinist, but I think I can. Please give me your opinion. *A.*—Good draftsmen receive more than $15 to $16 per week, and first-class machinists also receive more. In our opinion, good machinists, with a technical education, energy and pluck, have as many opportunities, if not more, to obtain high-salaried positions than first-class draftsmen who have but little shop experience. If your shop experience in the different departments is limited, we should advise you to continue to work in the shop. If, on the other hand, you have worked in the different shops, or at various classes of work and have become familiar with the general routine of doing work, it will be advantageous to enter the drawing room. Of course, the wishes of your parents should also influence your actions.

(54) H. A. A., Jersey City, N. J., writes: I have bought a set of Swiss instruments. Since then I have seen several other sets by different makers, which seem just as good as mine, but I had to pay twice as much. Please inform me what causes the difference. *A.*—If you have bought the instruments of a first-class dealer, you have undoubtedly

better instruments than the cheaper sets you have seen. There is no conspicuous difference in the outward appearance in the good and the poorer grades of instruments; to the latter can be given an appearance equal to that of the best grade, and with their joints carefully lubricated, are liable to deceive experts, and certainly will deceive those who have no experience in the use of them. 2. I bought a book treating on mechanical drawing, which I believe is first-class in every respect, and easily understood. Is it possible to learn drawing from such books sufficiently to enable a person to enter a drawing room as a draftsman? *A.*—Yes; of course you will not be an experienced draftsman; it requires years of experience in practical and theoretical matters to become competent to fill any position in the drawing room; in fact, those who strive to be at the head of their profession never get through learning. 3. Did the AMERICAN MACHINIST ever publish instructions in drawing? *A.*—Yes, we have published a series of 93 articles on this subject.

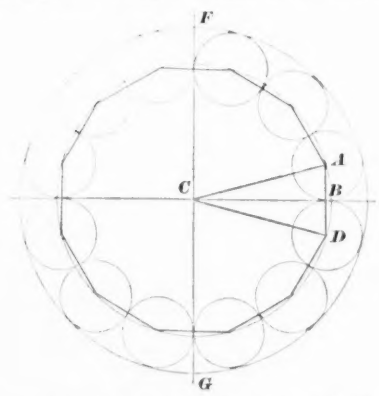
(55) C. A., Toronto, Canada, writes: I intend some time in the future to take a full course at some technical school such as we have in this city. I made inquiries in regard to what books beside geometry and algebra I should get in order to post myself a little before going. I was told that they would sooner have me not read any books at all, as I would be getting false views in my mind, which would be harder to get out than to get truth in. What is your opinion of this? *A.*—In our issue of February 19, 1891, in an article relating to "How to Study and What to Study," we have given a list of books suitable for home study. If these are carefully read, there will be no danger of getting false views. The advice given to you is not good; our advice is, if you cannot enter a technical school at present, do not lose any time, but provide yourself with good books, and study all you can. There are many technical institutions to which you will not be admitted unless you can pass an examination in various branches of technical knowledge.

(56) W. O. H., Wilmington, Del., writes: Please give me a rule or method for dividing a ring into three equal parts; say, for instance, the ring is 22 inches outside diameter and 19 inches inside diameter; the width of the ring is $\frac{3}{8}$ inch. *A.*—It is proved in geometry that the side of a regular hexagon is equal to the radius of the circumscribed circle. Hence, set a pair of compasses to the radius of the outer circumference, and lay this distance off six times on the outer circumference; this will divide it exactly into six equal parts. Through the points of division draw radial lines terminating in the inner circumference; this will divide the ring into six equal parts; two of these will be one-third of the ring. The same result could have been obtained by laying off the radius of the inner circumference on the latter, and then drawing radial lines to the outer circumference; but by following the first method more accurate results are generally obtained. The thickness of the ring has nothing to do with the solution of the problem.

(57) T., Harrisburg, Pa., writes: You will greatly oblige a constant reader of your paper by explaining the method of determining the clearance of an engine from an indicator diagram. I understand that the clearance is determined by the erection and measurement of ordinates of the compression curve, but do not thoroughly understand it. Please give an illustration and practical example. *A.*—The clearance space cannot be determined by an indicator card, but it is frequently required to mark this on the diagram, which may be done in the following manner: In the first place we must determine the amount of clearance space; this is frequently difficult to do, but if we remember the meaning of the term clearance, namely the space between the piston at the end of its stroke and the valve face, the following method will suggest itself in many cases. Suppose it is required to find the clearance space of an horizontal engine, its valve face lying in a horizontal plane. In this case the engine is placed on the dead center, and the clearance space filled with water; if now this quantity has been carefully weighed, the space it occupies will be known. Water at the temperature of 60 degrees will occupy a space of 27.7 inches per pound. Say that $6\frac{1}{2}$ pounds are required to fill the clearance space in a 16x32 inch cylinder, the cubic inches of space occupied by the water will be $27.7 \times 6.5 = 180.05$ cubic inches. The area of a 16-inch cylinder is 201.068 square inches, and the space swept through by the piston in a single stroke is $201.068 \times 32 = 6{,}434.176$ cubic inches; hence the clearance is $180.05 \div 6{,}434.176 = .028$ of the displacement. A proportionate amount must be added to the length of the card; that is to say, we must add .028 of the length of the diagram to it. If the diagram is $4\frac{1}{4}$ inches long the distance to be added to the initial pressure end of the card will be $4.25 \times .028 = .119$ inch. Through this point draw a line perpendicular to the atmospheric line, and the clearance will be indicated on the card. For further illustrations see "Indicator Practice and Steam Engine Economy," by F. F. Hemenway.

(58) R. V. H., Edwardsville, Ill., writes: Please answer the following: I want to pump hot air into a room for heating it. Now what I want to know is how to find the volume of air necessary to pump into the room to heat it to about 60 degrees Fahr. If, for example, the room contains 1,200 cubic feet, and the air pumped into the room is heated to 100 degrees, what is the volume of air that will have to be pumped into the room to keep its temperature at 60 degrees? I have a number of books treating on mechanics, but none give the information I seek. *A.*—There is a scarcity of data relating to the theory and practice of heating rooms in this way. Much depends on the temperature outside; the kind of building, whether it is one poorly put up or not, and whether it is an exposed or corner building, or one less exposed, as the intermediate ones of a cluster or block; the number of windows in the room must also be taken into account. From this it will be seen that it is impossible to give fixed rules applicable to all cases, and much will depend on good judgment. But it must be remembered that ventilation plays an important part in heating buildings. In regard to this, it is stated in Haswell's Mechanics and Engineers' Pocket-book, that from 3 to 5 cubic feet of air are required per minute in winter, and 5 to 10 cubic feet in summer for each occupant of a room. In D. K. Clark's Mechanical Engineer's Pocket-book it is stated that the quantity of air required for ventilation of buildings is variously estimated at from $3\frac{1}{4}$ cubic feet to 20 cubic feet per minute per head of inmates in ordinary good health. In public schools 1,800 cubic feet per hour per head is recommended; for theatres and concert halls, from 1,500 to 3,000 cubic feet; for hospitals, from 4,000 to 6,000 cubic feet. For each lamp or gas burner employed, from 30 to 60 cubic feet per hour should be provided.

(59) F. W. C., Springfield, Mass., writes: Please give us a reliable rule for determining the diameter of a circle into which a certain number of rings will fit on its inside. For instance, what is the diameter of a circle into which twelve $\frac{1}{4}$-inch rings will fit, as per sketch? *A.*—To make this rule plain, let us assume that we have found the diameter of the required circle, and have drawn the rings inside of it. Join the centers of these rings by straight lines, as shown; we then obtain a regular polygon with 12 sides, each side being equal to the diameter of a given ring. It is now easy to be seen that all we have to do is to find the diameter of a circle circumscribed about this polygon, and add the diameter of one ring to it, the sum will be the diameter of the circle into which the rings will fit. Through the centers *A* and *D* of two adjacent rings draw the radii *C A* and *C D*; since the polygon has twelve sides, the angle *A C D* will be $\frac{360}{12} = 30$ degrees; and one-half of this angle, that is, *A C B*, will contain 15 degrees. Now, one-half of the side *A D* is equal to *A B*. We can now give the following proportion: The sine of the angle *A C B* is to *A B* as 1 is to the required radius. From this we get the following rule: Divide *A B* by the sine of the angle *A C B*; the quotient will be the radius of the circumscribed circle; add to the corresponding diameter the diameter of one ring; the sum will be the required diameter *F G*. To show the application of this rule we will work out the example. The sine of the angle *A C B* is .258819; the length of *A B* is .25, hence the radius *C A* is $\frac{.25}{.258{,}819} = .965$ inches, and the diameter *F G* is $.965 \times 2 + .5 = 2.43$ inches.



(60) E. M. L., Minneapolis, Minn., writes: In your issue of the 29th of December, C. A. S., Chicago, asks how to find the pitch diameter of a sprocket wheel. The answer given is neither practically nor theoretically correct. No different method is used for the pitch of a sprocket wheel than for gears. The chain is an internal gear and the sprocket is a pinion in mesh with it. *A.*—It seems to us that our correspondent must have read the question rather hastily and overlooked the fact that the chordal pitch and not the circular pitch was given. Before we answered the question we made a drawing of the wheel to a large scale, and we know that our answer is practically correct. It is also theoretically correct, with the exception of that statement to which we drew attention, and plainly stated that it was not exactly true, but gave results sufficiently close for practical purposes. We have lately seen an engineer who had a sprocket wheel to design; he also overlooked the fact that he had the chordal pitch to deal with, and when the wheel was cast according to his design it was thrown into the scrap heap. 2. In the same issue K. & J. ask for rules by which to build chimneys for crucible furnaces, and are advised to build a square chimney and, if less than thirty feet in height, to make the walls four inches thick. Nothing could be worse than such a construction, and no authority or precedent can be found for making the walls of a chimney less than one brick in thickness, and a square chimney is the worst form that can be built, a round chimney being better in every way. *A.*—We are well aware that a round chimney is generally preferred by engineers, but since it is an expensive one to build, the square form is frequently adopted. The question in regard to the thickness of walls was referred to an architect, from whose designs a number of chimneys have been built; he gave us the figures. Recent inquiries among other builders convince us that it would have been better if we had given eight inches for the thickness of the outer walls.

(61) J. J. M., Watertown, N. J., writes: I have a chance this spring to run a triple-expansion engine on a steam yacht. I want to take out a license to run in government waters. I know there are three grades of engineers, but would like to know how the grades are divided by the inspectors. Do the questions asked relate to the management of engines and boilers, or do these also relate to the construction of engines and boilers? I have been told by an applicant for a license that questions were asked which mechanical engineers should answer. I understand that the duty of an engineer is to take charge of the engine and run it to the best advantage, and that he has nothing to do with the building of an engine. Am I correct? I shall be obliged if you will give me an idea of the questions asked, and also the duties of the different grades of engineers. *A.*—There is no regular set of questions asked; their character is such as to determine the qualifications of the applicant. An engineer's duty does not consist simply of starting, running and stopping the engine; he has a far greater responsibility; if anything goes wrong he must be able to locate the cause for the trouble, and know how to rectify it, or in case of a breakdown he must know how to make the necessary repairs, or at least to make such repairs as will enable him to run the boat into a port, and in all emergencies he must be self-reliant, show good judgment and act quickly, as frequently the lives of others depend on his ability. To qualify him for such a responsibility, he must know something of the construction of the engine, and it is, therefore, proper that in his examination questions relating to the construction of engines and boilers should be asked. The classification of engineers on the lakes and seaboard is as follows: Chief engineers of ocean steamers; chief engineers of lake, bay, and sound steamers; chief engineers of river steamers; first assistant engineers; second assistant engineers; third assistant engineers; special engineers. All steamers of over one hundred tons burden must carry at least one chief engineer. First assistant engineer may act as first assistant on any steamer. Second assistant may act as first assistant on steamers of 750 tons and under, and second assistant on any steamer. Third assistant may act as second assistant on steamers of 750 tons and under, and third assistant on any steamer. Special engineers may be assigned to act in any capacity for which they are qualified on steamers of one hundred tons and under. It is the duty of an engineer, when he assumes charge of the boilers and machinery of a steamer, to forthwith thoroughly examine the same, and if he finds any part thereof in bad condition, caused by neglect or inattention on the part of his predecessor, he must immediately report the facts to the local inspectors of the district, whose duty is to investigate the matter, and if the former engineer has been culpably derelict of duty, they will suspend or revoke his license. No original license shall be issued to any person to act as an engineer, except for special license on small pleasure boats, who cannot read and write, or who has not served at least three years in the engineer's department of a steam vessel, or as a regular machinist in a machine shop, provided that any person who has served for a period of three years as a locomotive or a stationary engineer may be licensed to act as engineer on steam vessels, after having had not less than one year's experience in the engineer's department of a steam vessel.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

Norway Rivets, Evans & Robertson, Cincinnati, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St, N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N Y.

S. A. Smith, 23 S Canal St., Chicago, Ill, is agent for Standard Tool Co.'s Twist Drills.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co, Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M C. Bullock Mfg Co., corner Canal and Washington Sts., Chicago, Ill.

Combination Gear Cutters in stock. Vertical Miller, Drill and Slotter in one machine, worth its weight in gold. R. M Clough, Tolland, Conn.

We electrotype illustrations and advertisements for manufacturers. Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn.

Roper's Practical Handy-Books for Engineers & Firemen; Descriptive Catalogue mailed free. Edward Meeks, Pub., 1012 Walnut St., Philadelphia, Pa.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Balanced Compound Locomotive.

We give on page 10 illustrations of a new balanced compound locomotive designed by its inventor, C. A. Ball, of the Ball Compound Locomotive Co., 82 and 84 Church street, New York City. It embraces several new and novel features designed to overcome well recognized difficulties and which are worthy the attention of mechanics and engineers. The engine is of the four-cylinder type, having a high and a low-pressure cylinder on each side, the former being 13 inches in diameter and the latter 23 inches diameter, both 24 inches stroke; the driving wheels are 7 feet in diameter, and the weight on the driving wheels will be about 82,000 pounds. The high-pressure cylinder is placed in the rear of the low-pressure cylinder; the latter is placed as close to the frames as possible, and the former is moved sufficiently outward to clear the low-pressure piston rod; the whole arrangement is plainly shown in the plan.

The low-pressure piston is to be made of steel as light as is consistent with the work it has to do, and the high-pressure piston is to be of cast-iron, of such dimensions as to make its weight plus that of its piston rod equal to that of the low-pressure piston and rod. Separate guides, crossheads, main rods and side rods are used for each cylinder, the low-pressure cylinders being connected to the crank-pins next to the wheels;

the diameter of each one is equal to that of the axle, and each has an outer crank forged to it, to which the high-pressure cylinders are connected. These pins are pressed into the wheels and keyed.

The valves are designed to cause the high-pressure piston to move in a direction opposite to that of the low-pressure piston, thereby securing practically a perfect counterbalance, because the weight of the reciprocating parts actuated by the high-pressure cylinder is equal to the weight of the reciprocating parts actuated by the low-pressure cylinder, and these moving in opposite directions must counterbalance each other; the weights of the revolving parts are also equal, and being connected to opposite sides of the axle must also balance each other. By these means the use of counterbalance weights in the wheels is avoided, and the so-called "hammer blow" incidental to the simple locomotive is removed, and a greater steadiness in motion, and less wear and tear secured.

The low and high-pressure valves are operated in one steam chest. The high-pressure valve is a plain piston or plug valve without any packing rings to make it steam-tight. A valve of this kind can always be made sufficiently tight for the work it has to do; the small amount of steam, if any, that may leak through, is taken care of by the low-pressure cylinder, so that no loss can occur on this account. The annular cavity in this valve, which in ordinary engines would control the exhaust, is used in this engine for the admission of steam, and the outer edges of the valve control the exhaust. This valve works in an independent cage which is set on the valve seat of the high-pressure cylinder. With this arrangement the wear of the high-pressure valve seat is avoided, and since this cage can be very easily taken out, the labor and time for repairing this valve are reduced to a minimum, and the cost of repairing will be less than that of repairing an ordinary slide valve and its seat.

The low-pressure valve is an ordinary balanced slide valve and controls the admission and exhaust of steam in the usual manner. The valve rods on each side of the engine are connected to one rocker arm, the link is attached to the lower arm of the same rocker in the usual way.

The arrangement of steam and exhaust pipes in the smoke box is like that in a simple engine, with the exception that the exhaust pipe is moved further forward, so as to give to the current of the gases an easier path to the smoke stack, thereby insuring a stronger draught.

The steam is admitted to the high-pressure cylinder through the central port, and is exhausted into the steam chest, from which the low-pressure valve takes its supply.

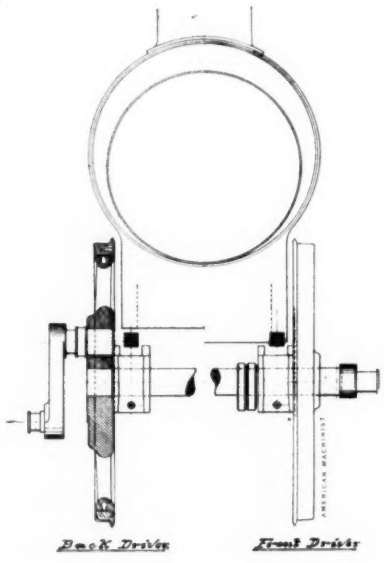
A starting valve, which also acts as a relieve valve at any time when steam is shut off and the engine is in motion, is in communication with the steam passages leading to the cylinder on each side of the engine. These valves being placed outside of the smoke box cannot be injured by cinders or excessive heat, and their construction being very simple are not liable to get out of order. Both are operated from the reverse lever, and the whole arrangement is such as to cause the engine to work as a simple engine when the links are set in full gear, and does not commence to work as a compound until the links are hooked up to cut-off at ¾ stroke. When working as a simple engine the high-pressure cylinders do no work, they simply take steam at one end as fast as it is exhausted at the other end, and the pressures on each side of the high-pressure pistons are equal, or nearly so, but this does not impede the action of the low-pressure pistons, which work under full boiler pressure, the steam being admitted to them through the starting valves which are open; but when the links are hooked up the starting valves close automatically, and the high-pressure cylinders do their share of work, and the engine works as a compound. From this it will be seen that the engine may be used as a simple engine for any length of time, and since, under these conditions, the 23-inch cylinders are in action, all the weight on the drivers can be utilized, giving the engine an increase of power in starting or in doing extra heavy service.

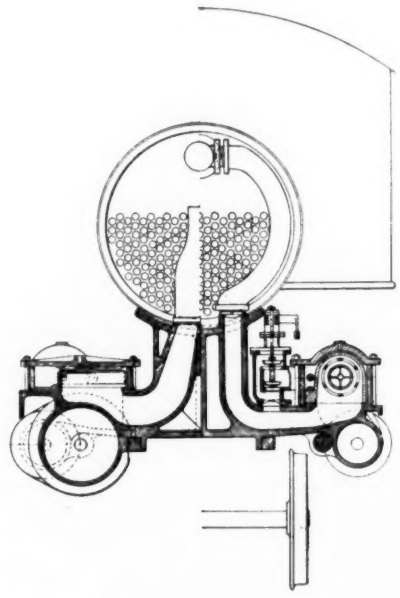
To change from simple to compound all that is necessary is to move the reverse lever a notch or two from full gear, and since the arrangement of levers, cocks, valves, etc., in the cab is precisely the same as that in a simple engine, no extra mechanism of any kind in the cab being required for the compound, the engineer requires no special training for running the engine.

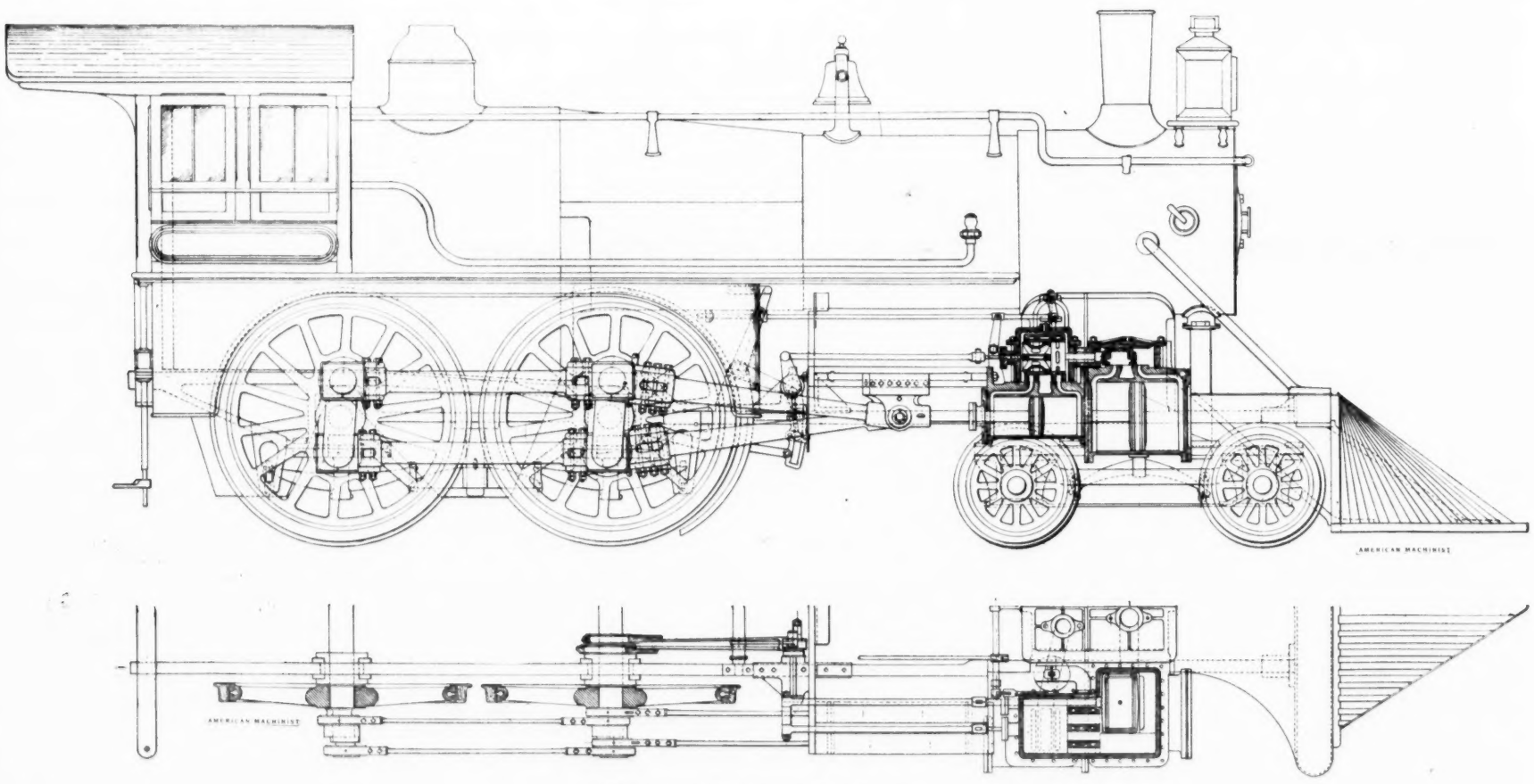
In connecting the main and side rods as shown, the axles will exert a constant pressure against the bearings in the axle boxes without any shocks, such as occur in simple engines; this increases the steadiness of running and reduces the stress in frames and some of the working parts. The low-pressure cylinders, which perform the maximum amount of work, and are used in starting, are placed next to the frames, so as to connect them to the pins next to the wheels, thereby avoiding an excessive stress on the outer cranks and pins.

There is no receiver; the cylinders are placed as close together as is practicable, and the steam passage from one cylinder to the other reduced to the smallest extent so as to avoid a loss by condensation.

In these days the tendency in locomotive practice is to increase the diameter of the driving wheels so as to obtain a high speed on the rails with a comparatively slow piston speed.







BALANCED COMPOUND LOCOMOTIVE.

To introduce large driving wheels under simple engines and retain sufficient power at starting often presents difficulties not easily overcome.

One of the principal features in this system of compounding is that large driving wheels, as far as power is concerned, can be advantageously employed, because at starting the large cylinders with full boiler pressure can always be used, giving the engine sufficient power to start any train that she can haul at a high rate of speed with an economical use of steam.

In case of an accident on the road, and injury to the machinery, the engine can be run, if required, with one, two or three cylinders. An engine of this type is soon to be built, and its tests in actual service will be watched with interest.

A Universal Calculator.

In our issue of October 29, 1891, we have given an illustration of a calculator brought out by Walter Hart, 114 Liberty street, New York. This instrument has recently been remodeled, with the object of reducing its cost and to give it a wider field of usefulness. The principle of construction is that of the slide rule. The instrument gives accurate results, and is well adapted for the calculations required in the counting room and office, in all departments of business, in the machine shop and in the study of the professional man; its use saves time and labor. It is constructed entirely of metal, except a wooden base to stiffen it, and a lens to magnify the finer lines. The instrument is 8½ inches square; the scales differ in color, rendering reading easy. The other metallic parts (brass) are nickel-plated, the whole being nicely finished, giving it a handsome appearance. Its operation is easily acquired from the book of instructions which accompanies each instrument.

S. A. Smith.

Mr. S. A. Smith, who started in life as a machinist, afterwards was engaged in the hardware business in New Haven, and for some years has been a tool dealer, especially representing the Brown & Sharpe Mfg. Co. in Chicago, died at the Astor House, in this city, Sunday the 5th inst. He had been previously ailing at his home in Chicago, but had become some better, and started East on a business trip against the protests of his wife and daughter, who, with his sister, were sent for when he became again ill. Mr. Smith was 58 years of age and a general

favorite amongst his very large circle of acquaintances.

MANUFACTURES

Pullen, Shorey & Co., the Augusta (Me.) harness manufacturers, are enlarging their business by putting in new machines and increasing their force to 45 men. They have just bought a large amount of new stock, and are receiving orders in abundance for the manufactured goods.

Out-of-town capitalists have leased the John L. Osgood granite quarry on Stark's Hill, Fryeburg, Me., and work will begin in the spring in opening and developing it. This granite is pink, like the granite quarried at Redstone, N. H., but is of rather coarser grain. It is susceptible of a fine polish, and is easily worked.

Mr. Albert L. Colburn, of New Haven, Conn., sends us a pamphlet describing his portable drilling machines, and Universal swing frame grinding machines, most of which our readers are familiar with, as they have been illustrated in our columns from time to time. The pamphlet also gives a list of users of these machines, and information regarding their use.

The Berlin Iron Bridge Co., of East Berlin, Conn. has received the contract for rebuilding the Tube-mill of Curtis & Co., at Cohoes, N. Y., lately destroyed by fire. The new plant will be fire proof, constructed entirely of iron and brick, no wood-work being used. The building will be 132 feet wide by 131 feet long, with a wing one side 20 feet wide by 74 feet long.

The Hayden & Derby Mfg. Co., of 111 Liberty St., N. Y., have issued a new pamphlet describing their line of Metropolitan automatic injectors for various services. The pamphlet contains perspective and sectional engravings, and also illustrates and describes proper methods of connecting and operating, and will be found useful to those interested in the subject of injectors.

The Berlin Iron Bridge Co., of East Berlin, Conn., will build the new machine shop for S. F. Hodge & Co., Detroit, Mich. The building will be 150 feet long and of the modern type, the central portion being 40 feet in width, controlled by a traveling crane of 20 tons capacity, with a wing on each side 22 feet in width, the wings being two stories high. When completed it will be one of the best machine shops in the northwest.

The Andrews Wire Works, of Rockford, Ill., which were burned recently, are to be rebuilt on a larger scale, and a new company formed, to be known as the Andrews Wire and Iron Works. The incorporators are: Chas. Andrews, Sr., Chas. Andrews, Jr., and Henry Collis. The capital stock of the new company is $20,000. The organization of the company will be proceeded with at once, and work begun on the new factory building. The structure will be built on the site of the old building, and will be three stories high.

The Whitlock Coil Pipe Co., of Elmwood, Conn., issue a small pamphlet describing the American feed-water heater, and giving illustrations of its application to variously arranged steam plants, and in connection with condensing, non condensing, simple and compound engines. It also illustrates what are called Anhydros ammonia fittings and coils, made with special hydraulic bending machinery which the company has devised. These coils, as illustrated, are admirable specimens, and the pamphlet will be found useful to those interested in such matters.

We have received from the Boston Blower Co., of Boston, Mass., three catalogues, one of them being a general catalogue describing the cupola, forge, exhaust fans and shaving exhausters made by this company. The catalogue is well illustrated and printed, and supplied with tables showing prices, speeds, capacities and principal dimensions of the various fans made, and has also diagrams showing methods of piping, and placing the machinery in buildings which are to be heated and ventilated, and in dry kilns through which a current of heated air is to be forced. The company also issue catalogues "H" and "K," the former devoted especially to the hot blast apparatus used for heating and ventilating, as made by this company, and the latter especially to dry kiln apparatus. All these are useful catalogues to those who are interested in the subjects to which they pertain.

Machinists' Supplies and Iron.

NEW YORK, February 4, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.75 to $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20 for Eglington.

Antimony—The market is steady. We quote L. X., 10½c. to 10⅝c.; Cookson's, 10¾c. to 10⅞c.; Hallett's, 10⅛c. to 10⅜c., and U. S. French Star, 10⅛c.

Copper—The market is weak; Lake Copper is quoted at 12¼c. to 12½c. Buyers are holding off in an icipation of lower prices. Casting Copper is held at 11¼c. to 11½c.

Lead—The market is more active; sellers are asking 4c., while 3.95c. may buy. Sales at 3.90c. have been reported, and there are eager buyers at the same price.

Lard Oil—Prime City is quoted at 99c. to $1; Western on spot at 98c. to 99c.

Spelter—The market is easy at 4.32½c. to 4.35c., according to brand. Buyers are disposed to hold off until the general metal market shows some sign of improvement.

Tin—An easier feeling prevails, with sales on spot at 20.05c., and March delivery at 20.17½c. Buyers are hesitating, as lower prices are expected.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM. MACH.

Wanted—First-class machinists. The Pond Machine Tool Co., Plainfield, N. J.

Mechanical draftsman, experienced designer, wants situation. Box 5, AMERICAN MACHINIST.

Wanted Situation—By first-class mech. draftsman; experience. Box 12, AMERICAN MACHINIST.

Designer & developer of fine mechanism & manager of men, seeks engagement. G. V., AM. MACH.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Wanted—A situation as foreman by one of experience, and a practical tool maker and die sinker. Morris Dean, Ilion, N. Y.

Wanted—Foreman in machine shop mfg. duplex steam pumps, employing 50 men. None but exp'd man wanted. Gardner Governor Co., Quincy, Ill.

Wanted—A draftsman; one who has had exp. in wood working machinery preferred; must be well up in modern draw'g room prac. Box 3, AM. MACH.

Wanted—Mechanical draftsman in mill engineer's office; must be neat workman; state salary expected. Address Box 7, AMERICAN MACHINIST.

Wanted—First-class tool and die maker; permanent position. Address Manufacturer, care Letter Carrier 21, Buffalo, N. Y.

Practical and theoretical machinist, speaking French and German, wishes to take charge of an exhibit at World's Fair. Box 10, AM. MACHINIST.

Wanted—Foreman for mining machinery and locomotive repairing by a good mine; well located; state age, experience, character and wages. Mine Machinist, AMERICAN MACHINIST.

A mechanical engineer, experienced in design and construction of steam engines, machine tools, etc., desires a position; New York or immediate vicinity preferred. Address E., P. O. Box 1,187, New York.

Foreman patternmaker, thoroughly familiar with machine tools, steam engine, gearing, and special machinery, desires to make a change; Mass., Conn., or R. I. preferred. Foreman, Box 14, AM. MACH.

Position wanted as sup't or assistant sup't of machine shop, by member of A. S. M. E., of 26 years' experience; now designer and assistant superintendent of shop manufacturing pumping machinery; 1st-class references. Box 8, AM. MACH.

Wanted—Superintendent or foreman capable of running 60 to 75 men; must understand engine and machine work, general job and foundry and boiler work; a good all round man who is not afraid of work may obtain a good position. Address Box 9, care AMERICAN MACHINIST.

A 1st-class mach. and draftsman may secure a permanent pos. as supt., with a concern mfg. mach'y for saw-mills, flour-mills, also iron work for bridges, buildings, etc.; location within 200 miles of Chicago. "Superintendent," care of *Northwestern Lumberman*, Chicago. State references, exp., and salary.

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Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

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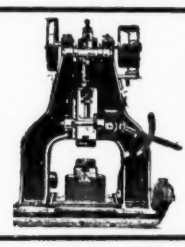

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If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

Send for list of Sapphire Corundum Wheels.

Edwards' Works on the Steam Engine

The Practical Steam Engineer's Guide in the Design, Construction and Management of American Stationary, Portable and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons and Rings, Safety Valves and Steam Gauges. For the Use of Engineers, Firemen, and Steam Users. By Emery Edwards. 119 engravings. 420 pages, 12mo. Price.....$2.50

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Cor. Curtis and Charles St.,
TOLEDO, OHIO,
Manufacture The Best and Most Complete Line of Hand And Power
PIPE THREADING MACHINERY IN USE.

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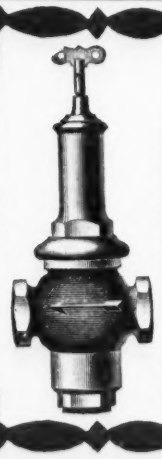
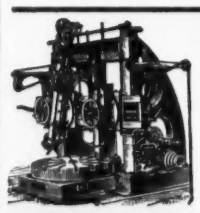
THE MASON REDUCING VALVE.



This valve is designed to reduce and maintain an even steam or air pressure regardless of the initial pressure. It will automatically reduce boiler pressure for steam-heating coils, dry-rooms, paper-making machinery, slashers, dye kettles, and all places where it is desirable to use lower pressure than that of the boiler. The dashpot, which immediately fills with condensation, prevents all chattering or pounding, and requires no attention. No extra lock up attachment is needed, as the pressure is regulated by a key, which the engineer retains. The sizes, up to and including 2-inch, are made of the best composition, and above that, of cast iron, with composition linings. In the larger sizes the composition lining is hung up in the valve, leaving a space between the iron and composition for the unequal expansion of the metals, thus there is no possibility of the piston sticking when the valve is heated. The area of the passage from the high to the low pressure side of the valve is equal, when open, to the full area of the pipe, so that a low pressure of the system, almost equal to the initial high pressure, may be carried. This valve will maintain an even steam or air pressure as low as one pound if necessary. We make an iron valve for use with ammonia in ice-making machinery.

MASON REGULATOR CO., Boston, Mass., U. S. A.



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We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

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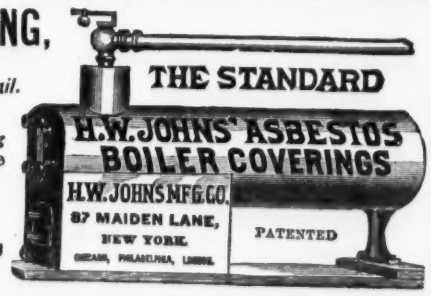

✲WANTED✲

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A position wanted, by an engineer of 30 years' experience in the designing and constructing of marine engines and general machinery; have no objections to go south or southwest; can work men to advantage: the best of references. Address A. B., AMERICAN MACHINIST.

Wanted—Position as manager or sup't, by a man with experience in shop, drawing room and business, who knows the value and importance of system, method, discipline and economy to reap dividends, and can practice his preaching. Address Engineer, care AMERICAN MACHINIST.

Wanted—A first-class energetic machinist as foreman in a machine shop manufacturing coal mine hoisting and haulage engines; must be competent and well up in modern shop practice, and have good executive ability; a permanent position to such a man, and no other need make application as it will only lead to disappointments. Address, stating age, experience, habits and salary expected, to Foreman, Box 11, care AM. MACH., New York.

Wanted—A foundry foreman, who is accustomed to general foundry work, including engine cylinders and castings of large and small size, car and building castings, in a foundry employing about 60 molders; applicants must be well up in dry sand and loam work, and understand irons and the most economical methods of melting, and be thoroughly familiar with piece work; none but first-class men need apply; state age, experience, and salary required; a good salary will be paid to the right man. Address X. Y., BOX 13, AMERICAN MACHINIST.

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1 25 in. x 25 ft. L. W. Pond, Compound Rest, Rod Feed. Good order
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1 4 in. Hubbert & Rogers Cutting Off Machine. A1 condition
1 20 in. Prentice Bros. Drill, Wheel Feed, with Chuck. Good order
1 20 in. Reed Drill, Lever Feed, with Chuck. Good as new
1 3 Spindle Barnes Drill Press. Good as new
1 No 1 2-Spindle Garvin Drill. Good as new
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1 No. 2 Brown & Sharpe Screw Machine, Automatic Chuck and Wire Feed. A1 condition
1 15 in. x 5 ft Hendey Turret Lathe. Good order
1 15 in. x 5 ft. Jones & Lamson Turret Lathe, with 3 jaw Universal Chuck. Good as new
1 No. 2 Garvin Power Miller, Swivel Vise and Arbor. Good as new
1 No. 4 Garvin Miller, Arm, Vise and Arbor. A1 condition

Nearly 500 other New and Second hand Tools in Stock. Write for list and prices.

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72 in. x 48 x 33 ft. Planer 3 do
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42 in. x 42 in. x 16 ft. do 1 do
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23 in. x 21 in. x 5 ft. do 1 do
90 in. x 30 ft. Triple Gear Engine Lathe, Ames A1.
60 in. x 45 ft. Double Engine Lathe.
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42 in. x 30 ft. Engine Lathe.
50 in. x 30 ft. Bed, Triple Geared. New Engine Lathe.
30 in. x 28 ft. D. W. Pond Shafting Lathe.
32 in. x 12, 14, 16, 18 ft. Bed. New Engine do
28 in. x 12, 14, 16, 18 ft. do do do do
21 in. x 10, 12 ft. do do do do
20 in. x 7½ & 8 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
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16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
14 in. x 6 ft. do do do do do
Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
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Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

For Sale—New Tools: Iron Planers, plane 24"x 24"x5 feet, $350: Screw-cutting Engine Lathes, 20" swing by 8-foot bed, $275. F. & A., AM. MACH.

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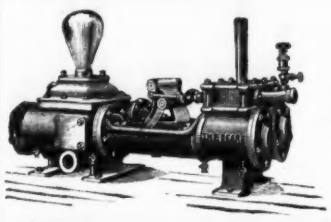

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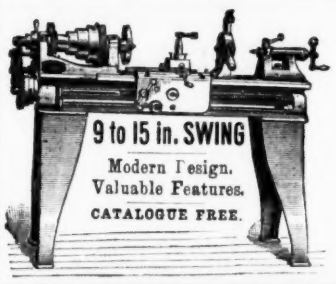

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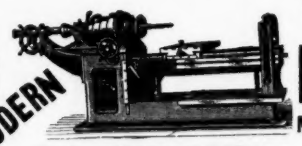

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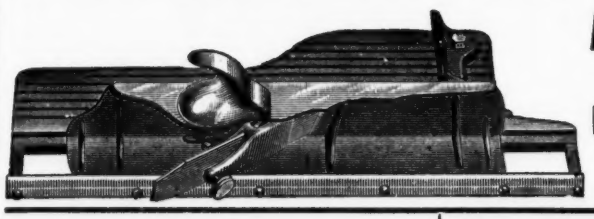

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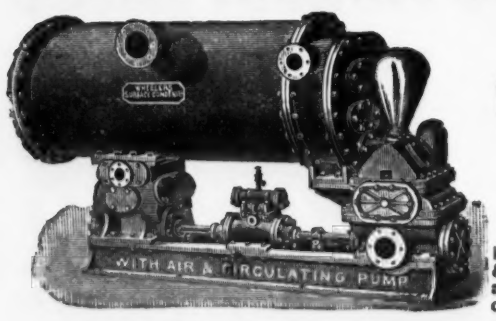

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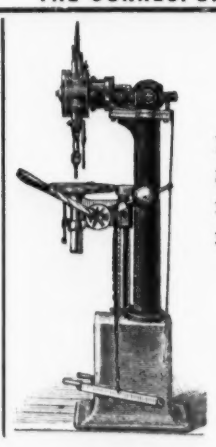

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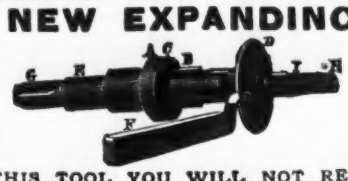

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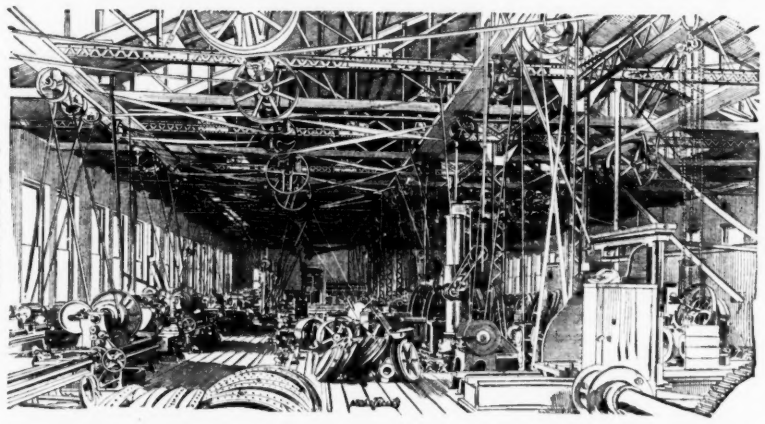

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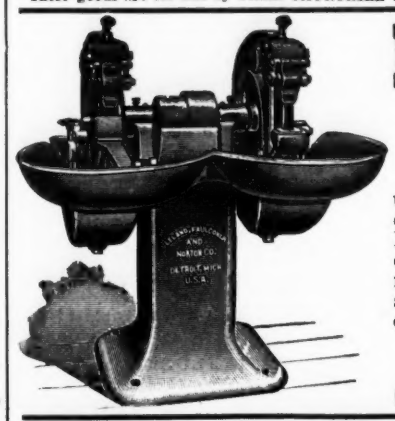

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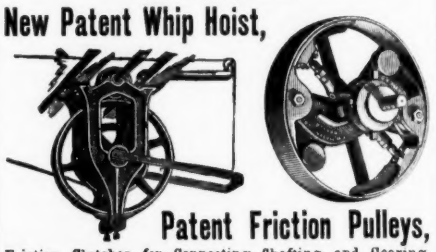

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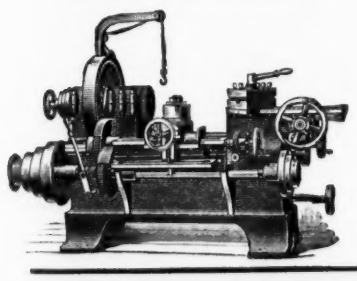

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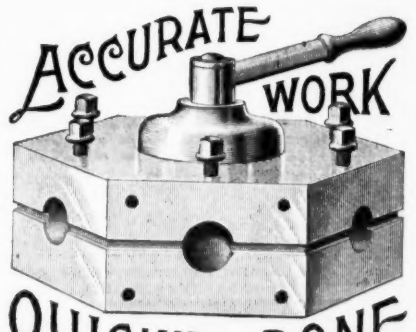

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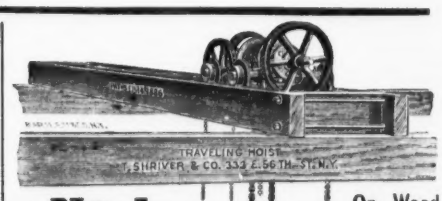

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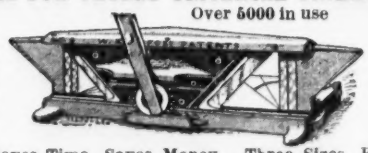

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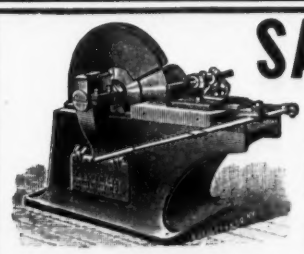

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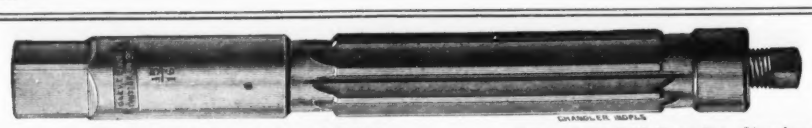

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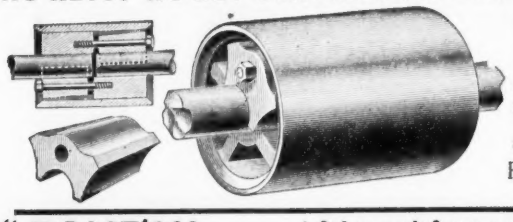

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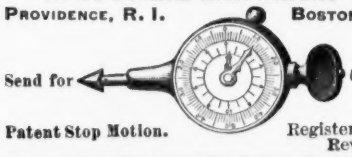

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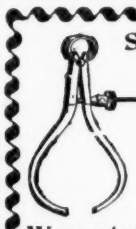

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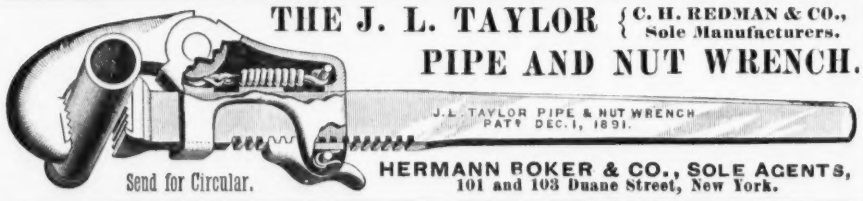

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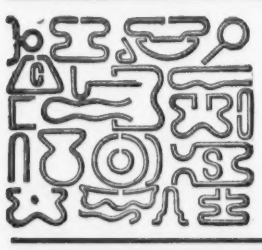

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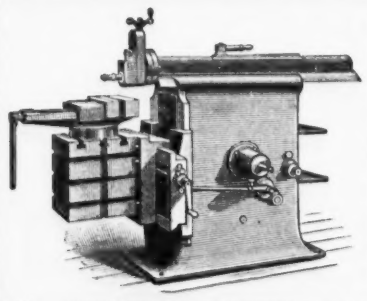

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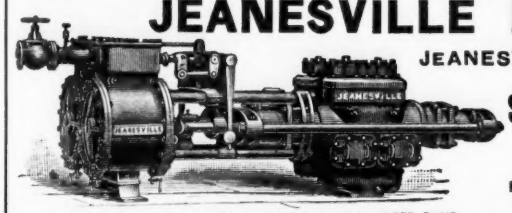

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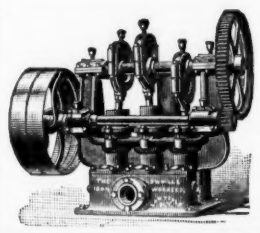

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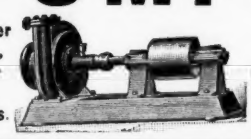

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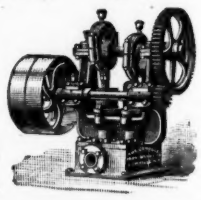

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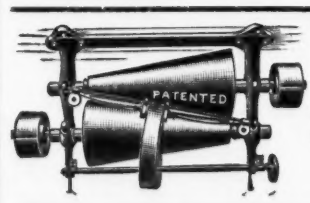

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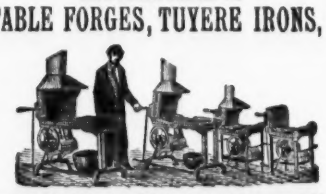

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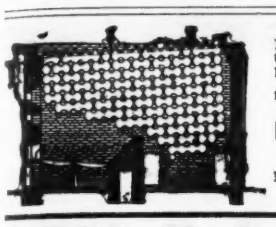

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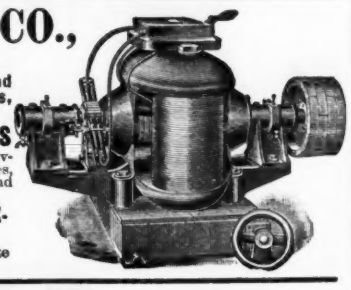

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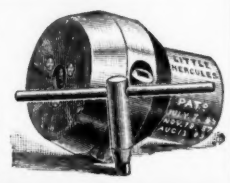

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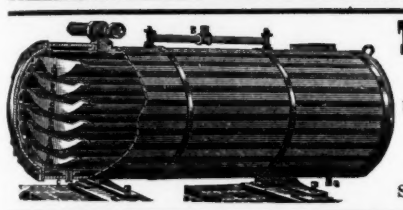

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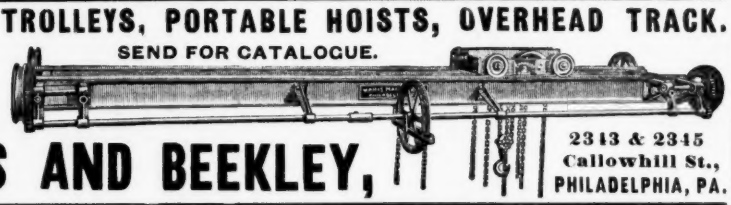

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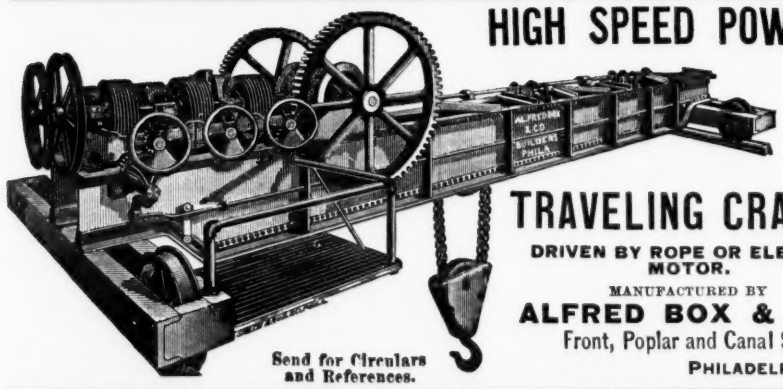

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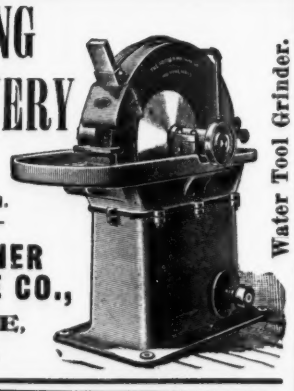

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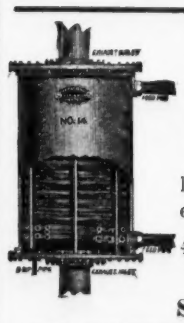

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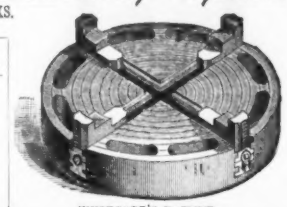
16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1-4 in.	25 in.
24 in.	30 in.
30 in.	36 in.
36 in.	43 in.



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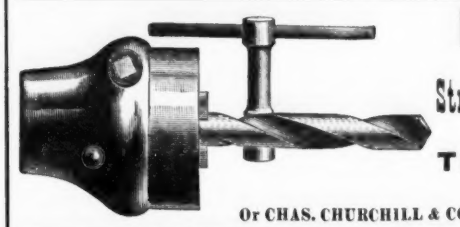

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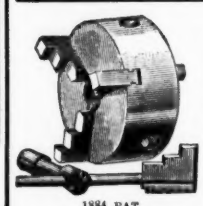

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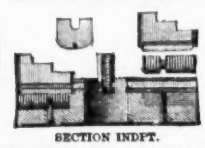

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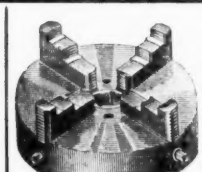

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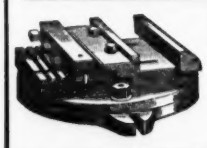

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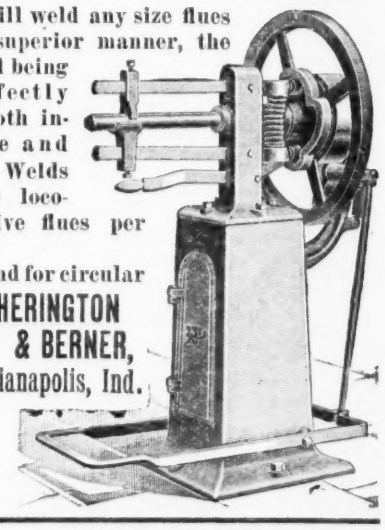

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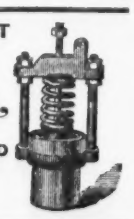

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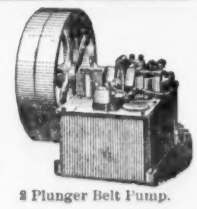

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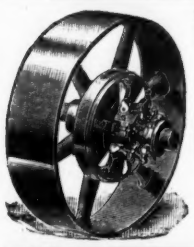

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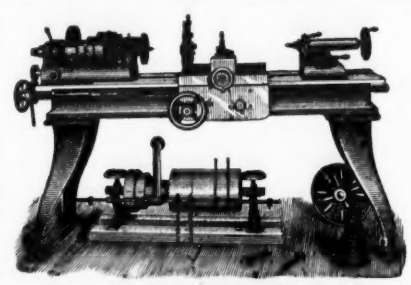

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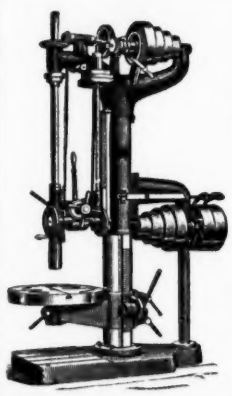

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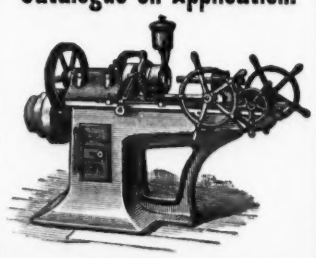

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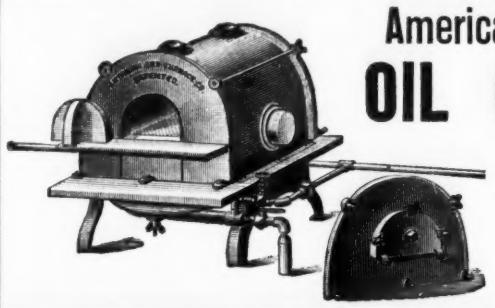

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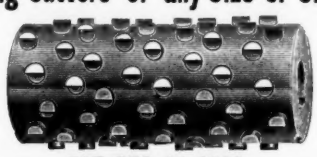

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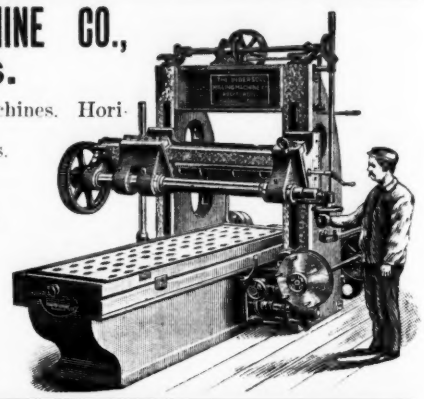

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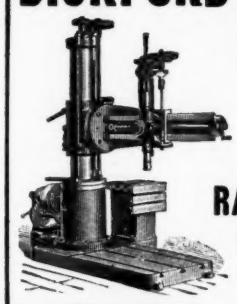

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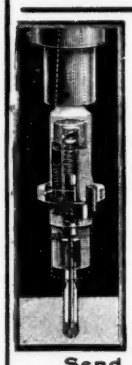

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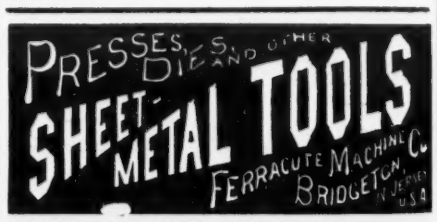

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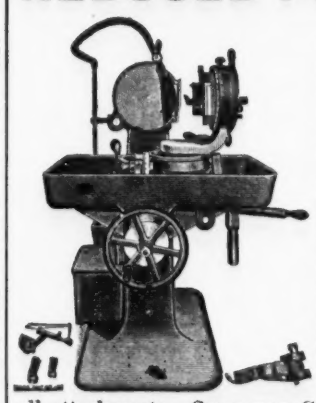

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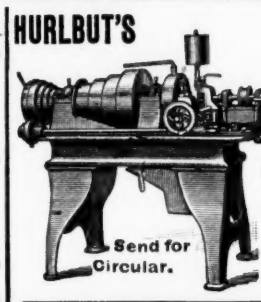

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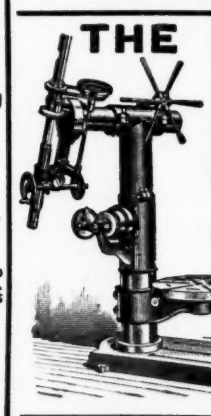

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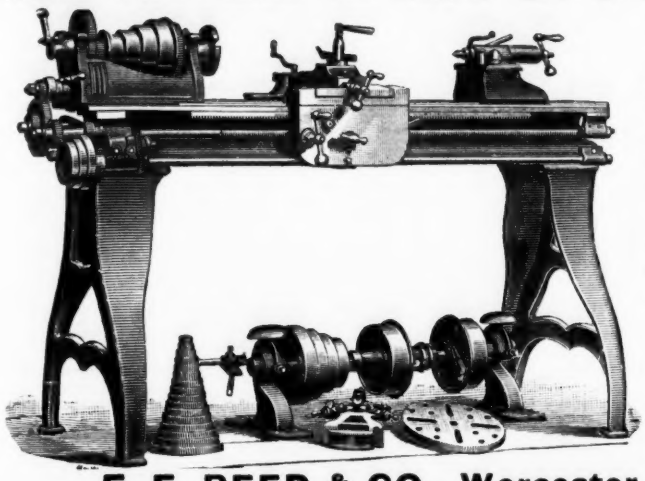

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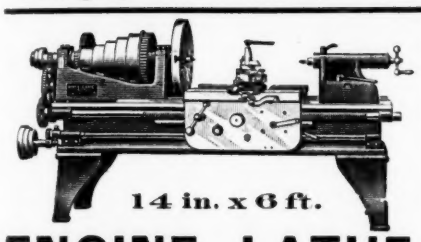

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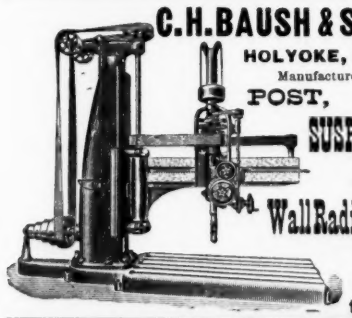

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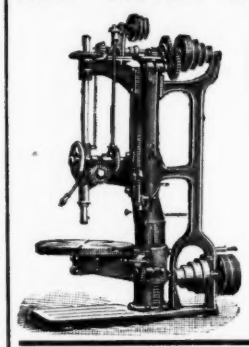

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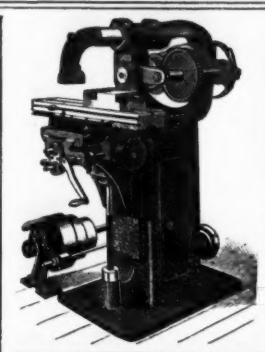

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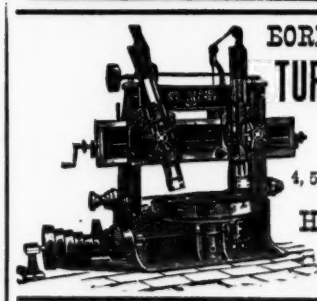

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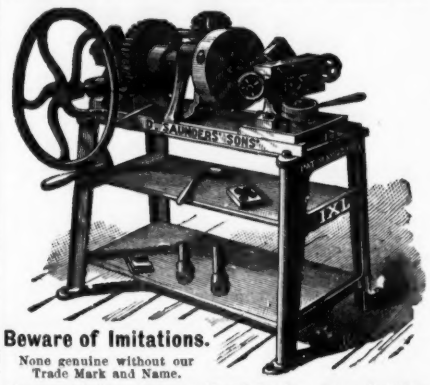

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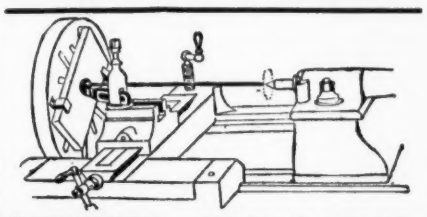

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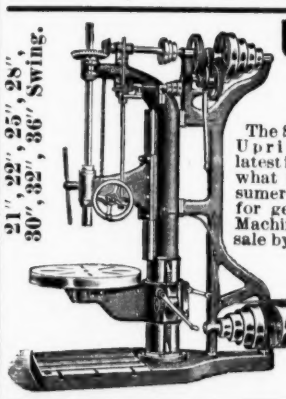

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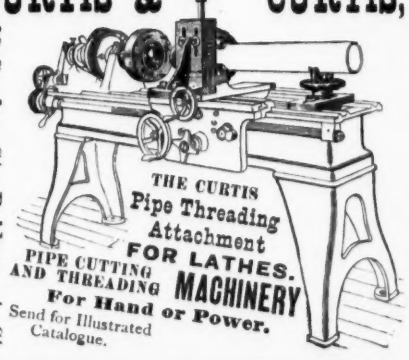

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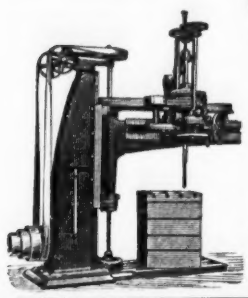

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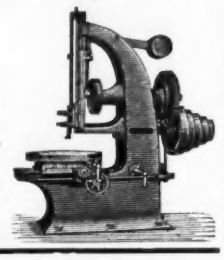

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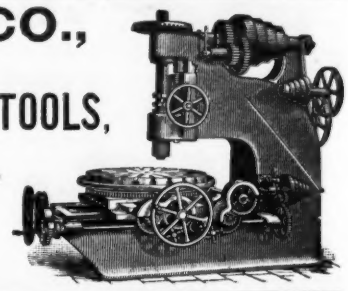

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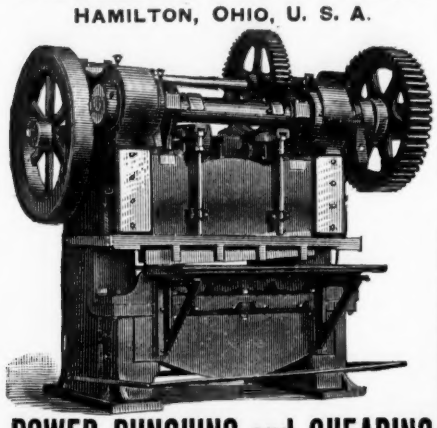

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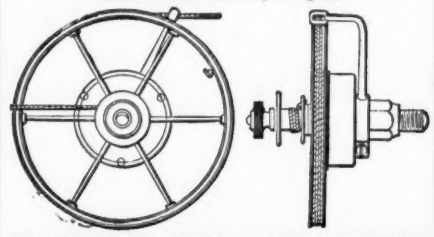

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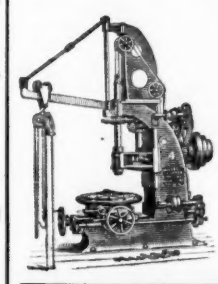

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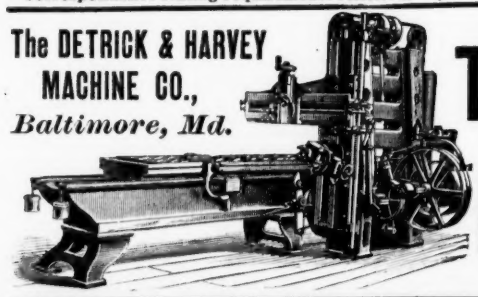

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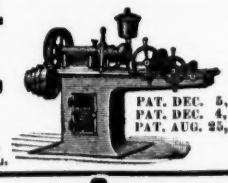

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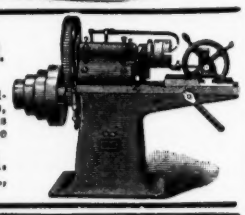

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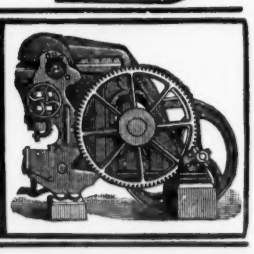

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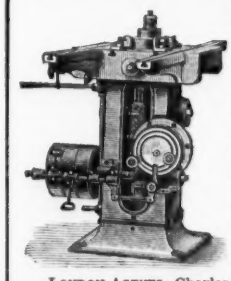

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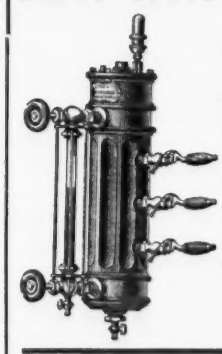

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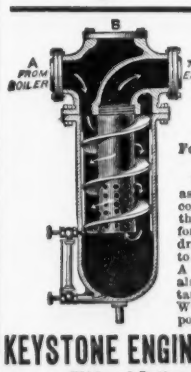

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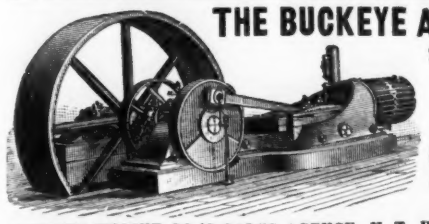

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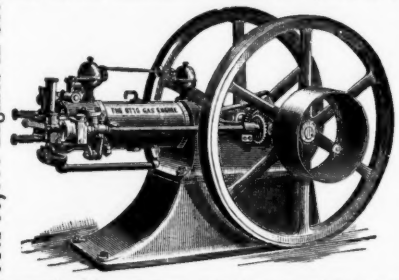

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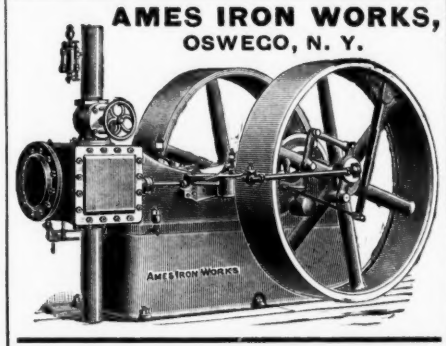

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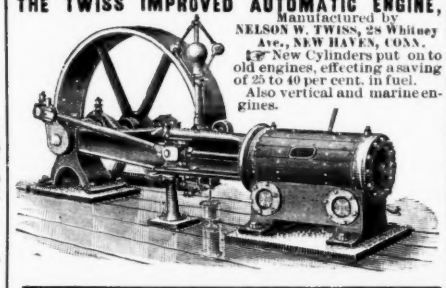

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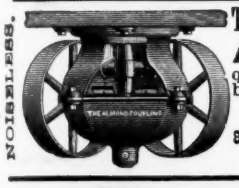

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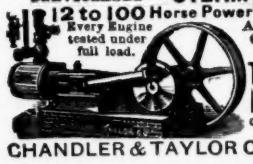

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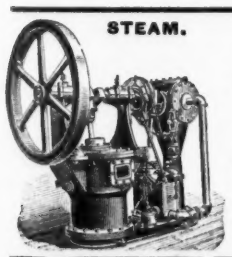

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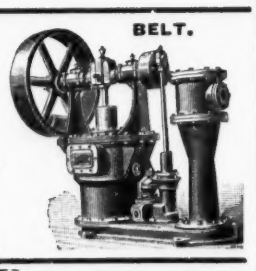

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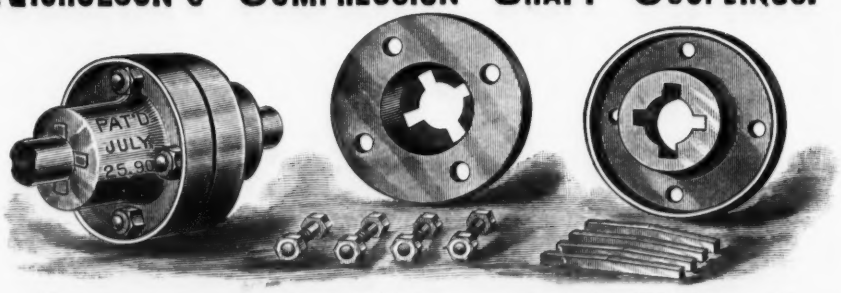

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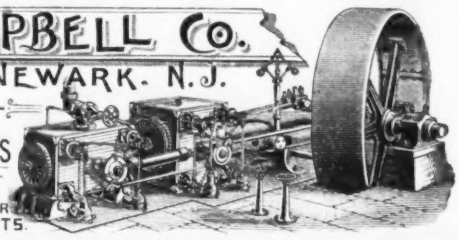

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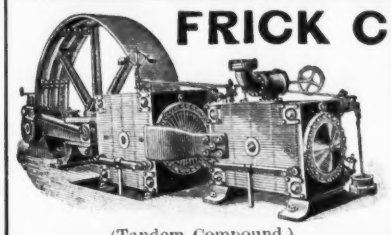

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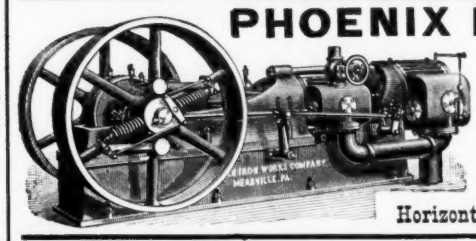

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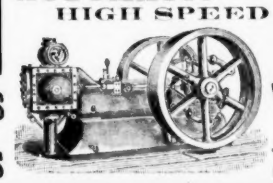

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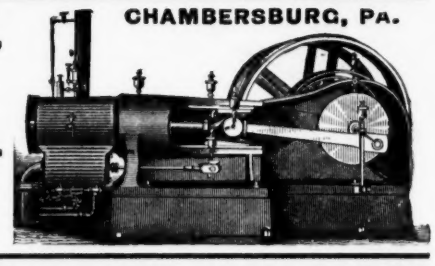

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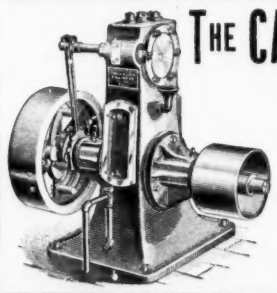

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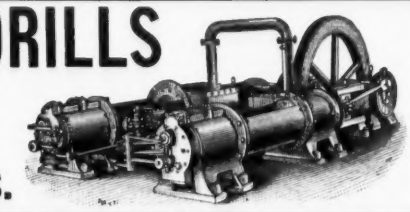

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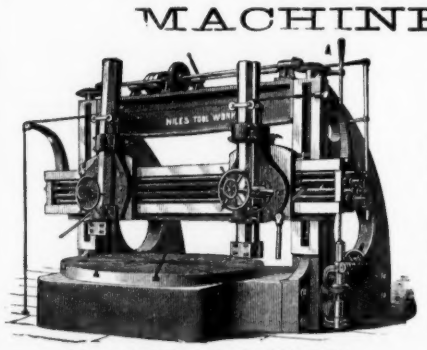

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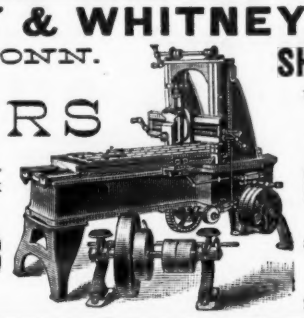

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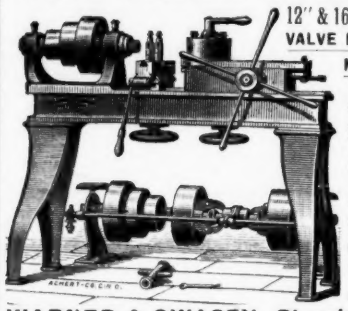

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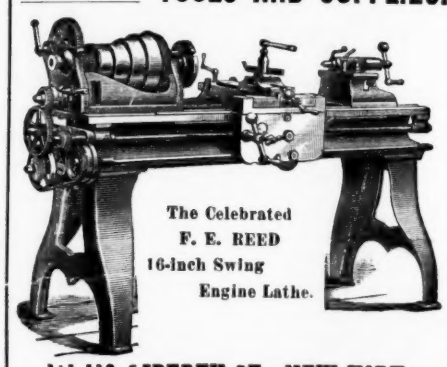

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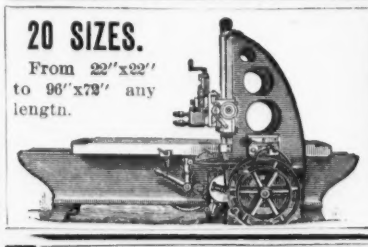

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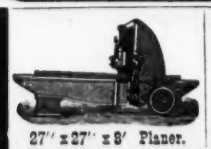

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